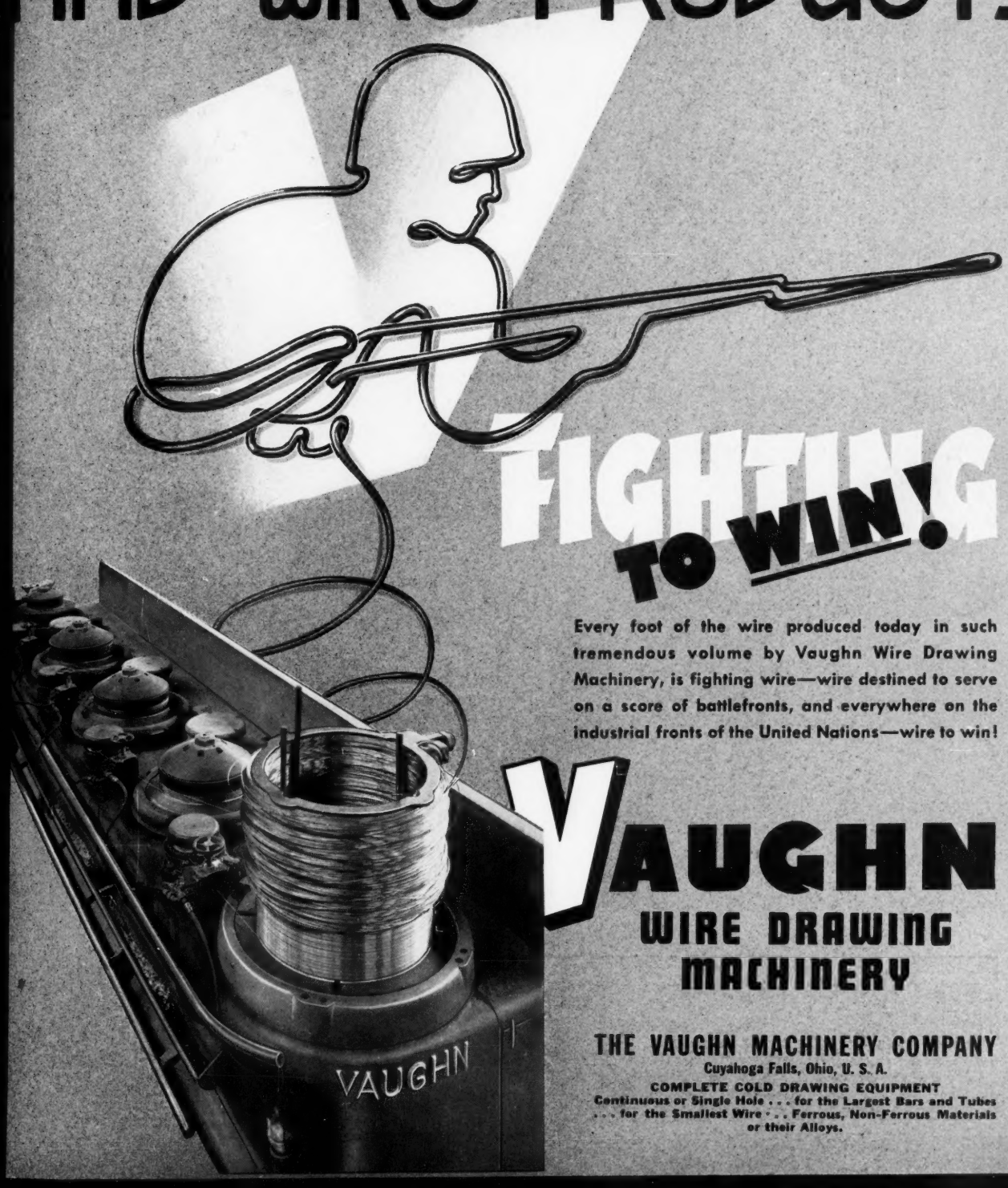
WIRE AND WIRE PRODUCTS

APRIL 1943



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Every foot of the wire produced today in such tremendous volume by Vaughn Wire Drawing Machinery, is fighting wire—wire destined to serve on a score of battlefronts, and everywhere on the industrial fronts of the United Nations—wire to win!

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WIRE DRAWING MACHINERY

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OFFICIAL PUBLICATION OF THE WIRE ASSOCIATION

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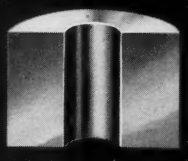
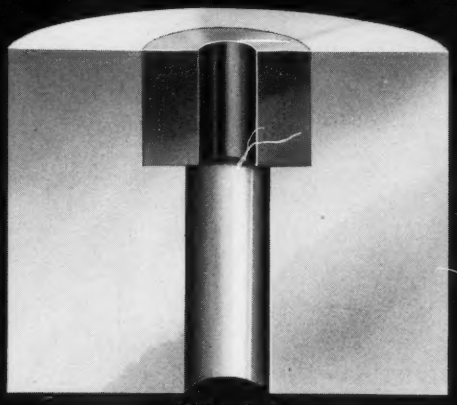
How to Keep Ample Emergency Reserves of Carboloy Extrusion Dies in Stock . . .

. . . At a relatively low investment cost



(Half-section)

"Cored" Extrusion Die Nib
(You mount in casing and finish)



(Half-section)

"Cored" Carboloy Extrusion
Die (You finish in your mill)

The practice of maintaining master stocks of carbide dies in "cored" form—and finishing those dies as needed, has become well known to those in the field of wire, bar and tube drawing. It has resulted in effective carbide die use with minimum die inventories, lowest possible investment cost, and efficient, fast replacement service. It has made these mills practically self-sufficient in getting carbide dies on the job immediately when needed.

These same benefits can also be obtained by those using carbide dies for *extrusion* work. The procedure involves simply the maintenance—in your mill—of master stocks of carbide extrusion dies and nibs in "cored" rather than finished form. With properly planned master stocks—in the lower priced "cored" state—your die room is in a position to quickly turn out finished carbide extrusion dies when needed. There are no delays awaiting outside deliveries. No long periods of idle press time. Your mill becomes "self-sufficient" for all immediate requirements.

We will be glad to work with you in planning your master stock, and training your die room personnel in the correct technique for finishing "cored" carbide extrusion dies.

What You Need to Finish "Cored" Extrusion Dies

"Cored" Carboloy Extrusion Dies may be finished properly on any good precision lathe. Only accessory supplies required are diamond boring tools, diamond powder and steel laps. Complete recommendations on request.

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CARBOLOY TRADEMARK **CEMENTED CARBIDES** TRADEMARK

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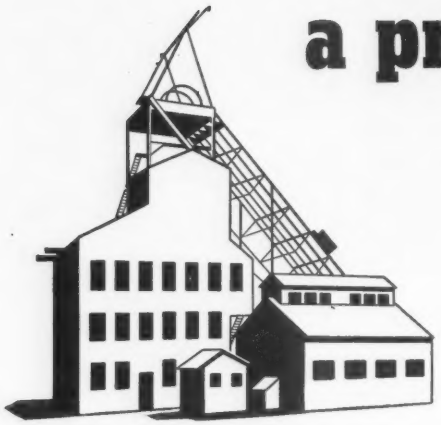
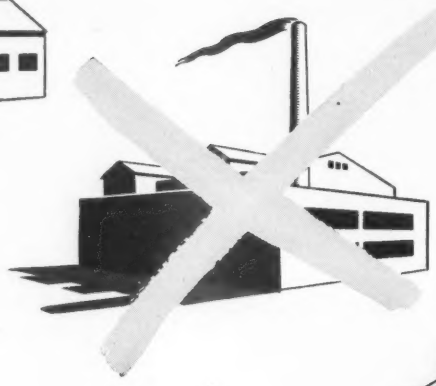
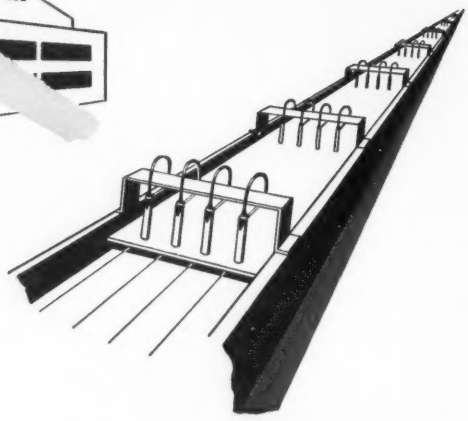
Bethanized Wire cracks a production bottleneck







One of the biggest bottlenecks in war-time zinc production is smelting equipment—the plants which turn raw zinc ore into bright corrosion-resistant metal.

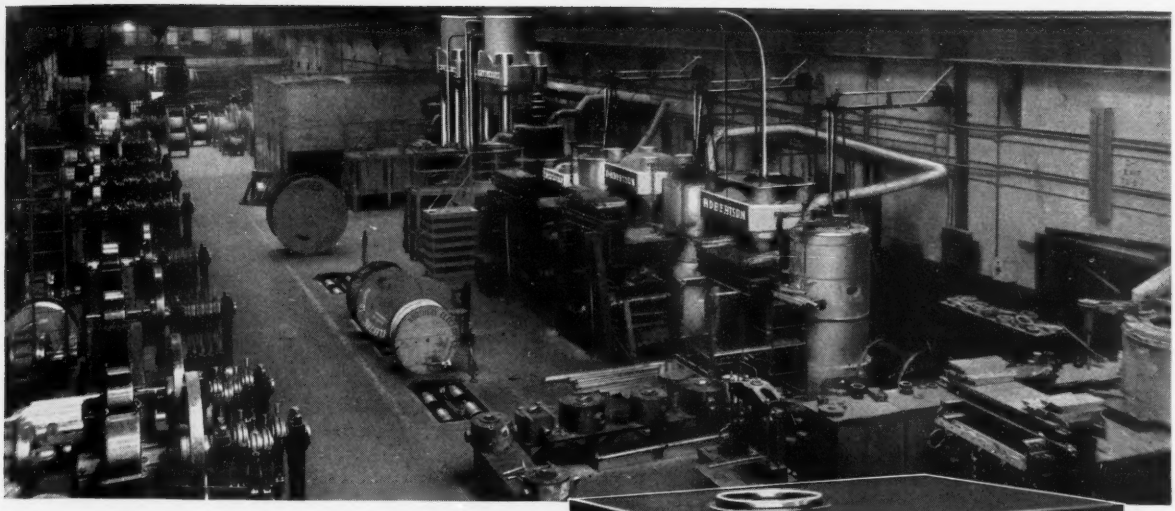
Bethanized wire has been able to crack open this bottleneck, because the zinc coating on bethanized wire is produced directly from the zinc ore. No smelting is necessary.

The electrolytic bethanizing process draws 99.9+ per cent pure zinc out of solution and deposits that zinc on the wire to form a coating that is uniform both *along* and *around* the wire; a coating that is so tight it won't flake or peel off even when the wire is drawn through dies. In addition to these advantages, a bethanized coating offers unusually good resistance to atmospheric corrosion, as this coating can be applied in double or triple weights.

Bethanized wire is doing many kinds of war jobs—from armoring submarine cables to providing a much-needed alternative material for brass in zippers on pilot's suits and parachute packs.

Under the stress of emergency, many new jobs have been discovered for bethanized wire, necessitating revision of all previous ideas as to its possibilities, and pointing to a far broader field of usefulness in the post-war years.

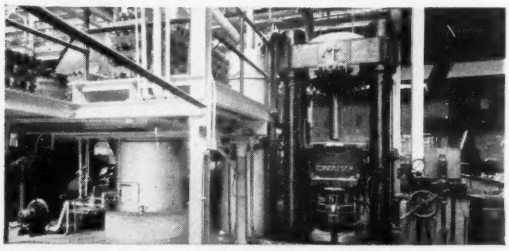
BETHLEHEM STEEL



The lead encasing die-block?...

ROBERTSON INVENTED IT!

MODERN COMMUNICATIONS through lead encased cables owes its steady development to Robertson lead encasing equipment like this, used by the *majority* of all cable makers in the U. S. A.



The lead encasing Die-Block for covering cables in a single operation was invented by John Robertson. This combination of press and die-block revolutionized the production processes of whole industries and established the basis for later, continuing Robertson leadership. For the first time, Robertson made it possible to cover wires and cables of any length with a continuous, close-fitting lead sheath. And, the principle applied to other industries alone made feasible the economical production of many familiar products. Knowing this, you can understand why, today, engineers everywhere consult with Robertson when there's any problem concerning lead encasing equipment.

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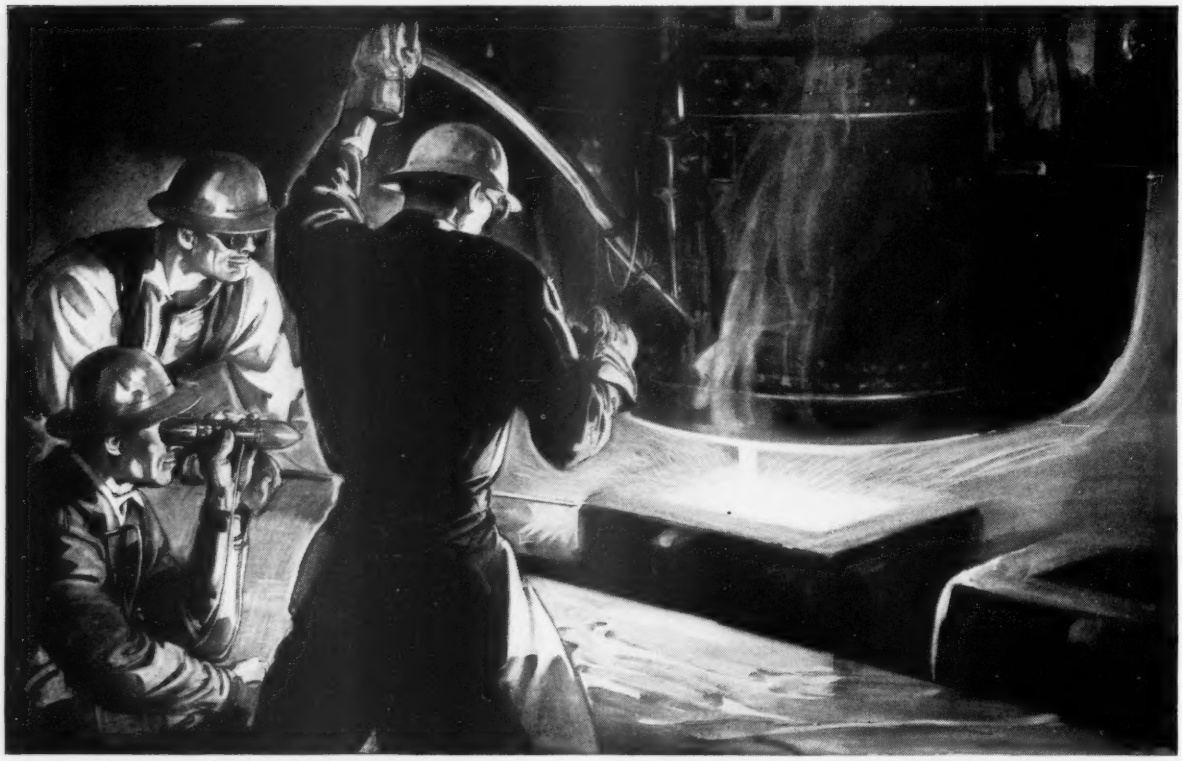
Established 1858 **• Designers and builders of Lead Encasing Machines and Hydraulic Equipment, Including Extrusion Presses, Hydraulic Pumps, Melting Furnaces and Pots, Dies and Cores, Hydro-Pneumatic Accumulators, Lead Sheath Stripping Machines, and Special Equipment for Special Uses.**

By doing many things a little faster, J&L is producing more steel for war



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FROM AN ORIGINAL DRAWING BY ORISON MACPHERSON

TEAMWORK POURING STEEL BACKS UP OUR FIGHTING MEN

America's steel mills today are producing steel for war at the all-time high rate of 95 million tons a year. This averages enough steel in one second's time to make four jeeps — a dozen gun-shields.

In the illustration you see a skilled crew pouring molten steel into man-high molds to become ingots — unit measure of steel production — steel in its first solid form. The men on the platforms and the cranemen maneuvering the huge ladles from aloft, make up real All-American teams, typical of those all along the steel front of 650,000 workers who are employing all their skill and teamplay to make every second count against the enemy and toward saving American lives on the battle fronts.

JONES & LAUGHLIN STEEL CORPORATION

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J&L STEEL

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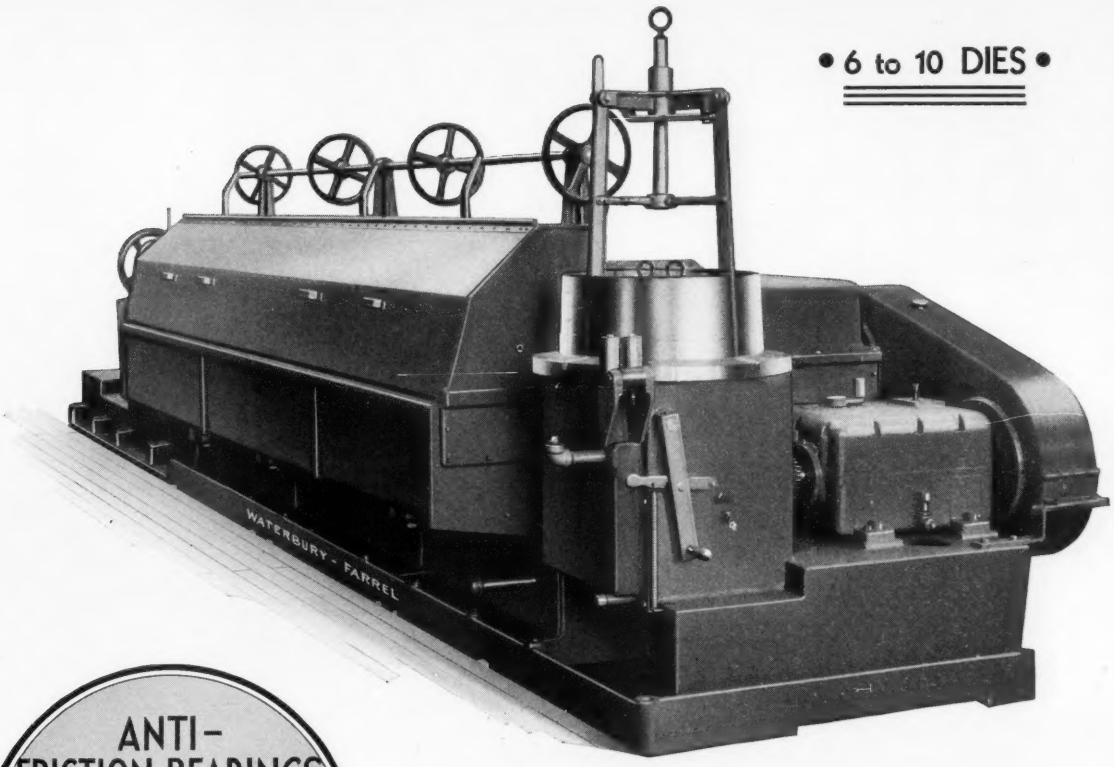

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Change gearing provides four finishing speeds with a single speed AC main motor.

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Not alone victory over the Axis—we'll have that—but in working out our future destiny.

With its faith, courage and capacity for initiative, will not the American spirit surmount all obstacles?

"Hail to the land whereon we tread,
Our fondest boast!
No slave is here—our unchained feet
Walk freely, as the waves that beat
Our coast."

— James Gates Percival

Out of the destruction of war are emerging the factors upon which we shall build. We are being enriched with new materials, machines, methods.

Should not industry now give thought to that future, express its courage, faith and hope by advertising what it is now doing? Many are. All should. Such advertising sets the pace of progress, paves the way for sound future enterprise and assures the advertiser that his will not be one of the forgotten names. It is one of the foundation stones that may be laid now, by means of which our vision may be attained.

The Wire Industry faces a greater future. Those identified with it can voice their confidence in this new era by addressing the field through

WIRE & WIRE PRODUCTS

300 Main Street

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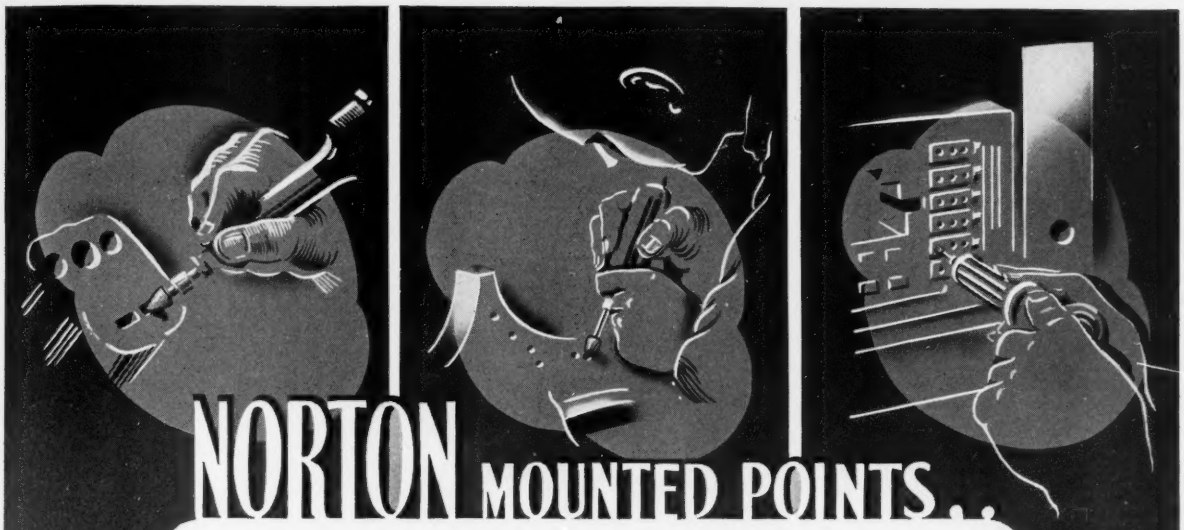
Official Publication of the Wire Association



NORTON MOUNTED POINTS..

Little Things That Can Be a Big Help

THERE are literally hundreds upon hundreds of war jobs on which these Norton spindle mounted grinding wheels can be a big help. Not only in the tool room for making molds and dies but on countless production jobs they provide the quickest and easiest way to remove metal. In air or electrically operated grinders they can be used by hand or mounted in lathes, millers, and other types of machines.

There's a Norton catalog that shows the complete lines of sizes and shapes. Write today—asking for Form 43 MF.

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Nearly 200 Standard Sizes and Shapes

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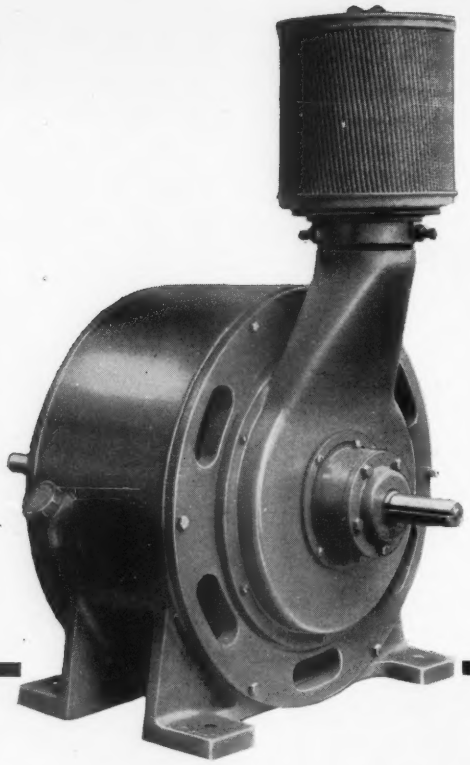

Many repeat installations prove the value of...

Syncro Magnetic Slip Clutches

SYNCRO Magnetic Slip Clutches were first made available to the industry several years ago. Since then, a large volume of repeat installations has proved that they measure up fully to the highest expectations.

Experience has shown that Syncro Magnetic Slip Clutches are ideal for installations where shockless starting and stopping, and completely controlled tensions are essential to the production of packages which must meet certain specifications.

Designed without mechanical slippage and without slip rings or moving electrical connections, and provided with intake air cleaners to insure cleanliness of internal operating parts, there is practically no wear on Syncro Magnetic Slip Clutches.

Built in many sizes, each rheostatically controlled to provide a range of from 0 to its maximum, Syncro Magnetic Slip Clutches are the logical solution for tension control and shockless drive problems.

For complete details, write for publication number 103.

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Machinery for the Wire Industry

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FOR DRAWING	For drawing fine wire, heavy wire, special shapes, tubing, etc. For shell and cartridge cases from the blank to completed case.
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FOR COLD NOSING	Artillery shells.
FOR EXTRUDING	For extruding operations on a wide variety of parts because of quantity and tolerance requirements.

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TANTALUM-TUNGSTEN CARBIDE DIES are now used for countless forming, nosing, drawing, cupping and extruding operations on articles of war materiel. Our special die department offers its services and experience to manufacturers making products requiring these operations.

If carbide dies can be used to advantage, we will design and produce Tantalum-Tungsten Carbide Dies that will assure you the ultimate in performance.

437

Ramet

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WORCESTER REGIONAL MEETING

of the

WIRE ASSOCIATION

to be held on

Friday, April 30, 1943, at 6 P. M.
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Make Your Plans to Attend This Conference Today

The technical session will be devoted to a discussion of the problems arising from

DRAWING ZINC COATED WIRE

Our Guest Speaker for the dinner will be Dr. Allan A. Stockdale, D.D., Ph.D., dean of the speakers of the National Association of Manufacturers. Dr. Stockdale is a veteran of the first World War and a well known author and editor. Those who heard Dr. Stockdale's address at the Annual Convention in 1941 agreed that he was exceptional and the most inspirational speaker they had ever heard.

A good motion picture — "ATTACK WIRE" — will be featured. This shows the end-uses of wire in actual combat and brings out the reason for the necessity of rigid adherence to manufacturing specifications.

DINNER

at 6:30 P. M. at the Bancroft

Registration Fee - $3.00 - Includes Dinner

Send your reservation early. Due to war conditions it is necessary for us to advise the Hotel Management on the number to be accommodated for dinner. Mail or 'phone reservations to

RICHARD E. BROWN

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New "STANDARD" HYDRO-FORMER

SHAPES AND JOINS METALS WITHOUT CUTTING . . .

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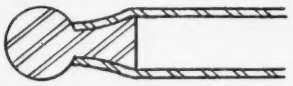
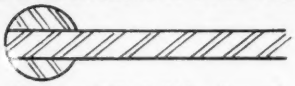
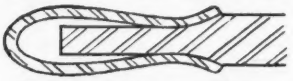


Tube Attachment to Solid Fitting



Ball and Rod Attachment



Union of Bar and Tube

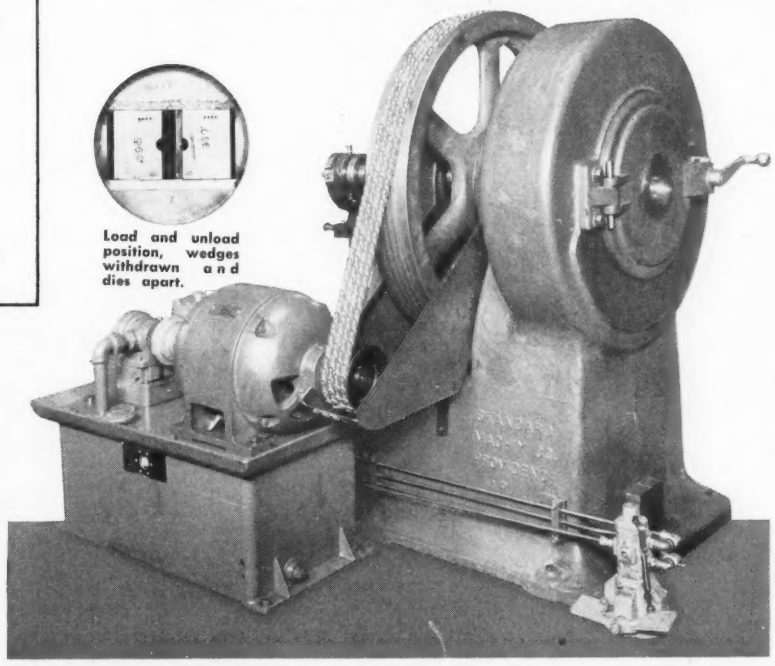
Metal Forms from Solid Bars

Union of Tubes

Terminal & Cable Attachment

In one operation, this machine connects tubing or cables to solid fittings, or forms metal sections from solid bars without cutting. A feature of its design is the use of hydraulically-operated wedges to compress the dies so that swaging force is applied at right angles to the work . . . not obliquely as with tapered dies. In reducing outside diameter of tubing, therefore, tendency toward elongation is lessened and thickness of tubing wall is increased. Fittings having large ends can be put into machine without removing dies. This machine simplifies handling of many other operations which previously required more complex, time-consuming methods.

Load and unload position, wedges withdrawn and dies apart.



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TIME
LABOR
METAL

Further information on request

STANDARD MACHINERY CO.
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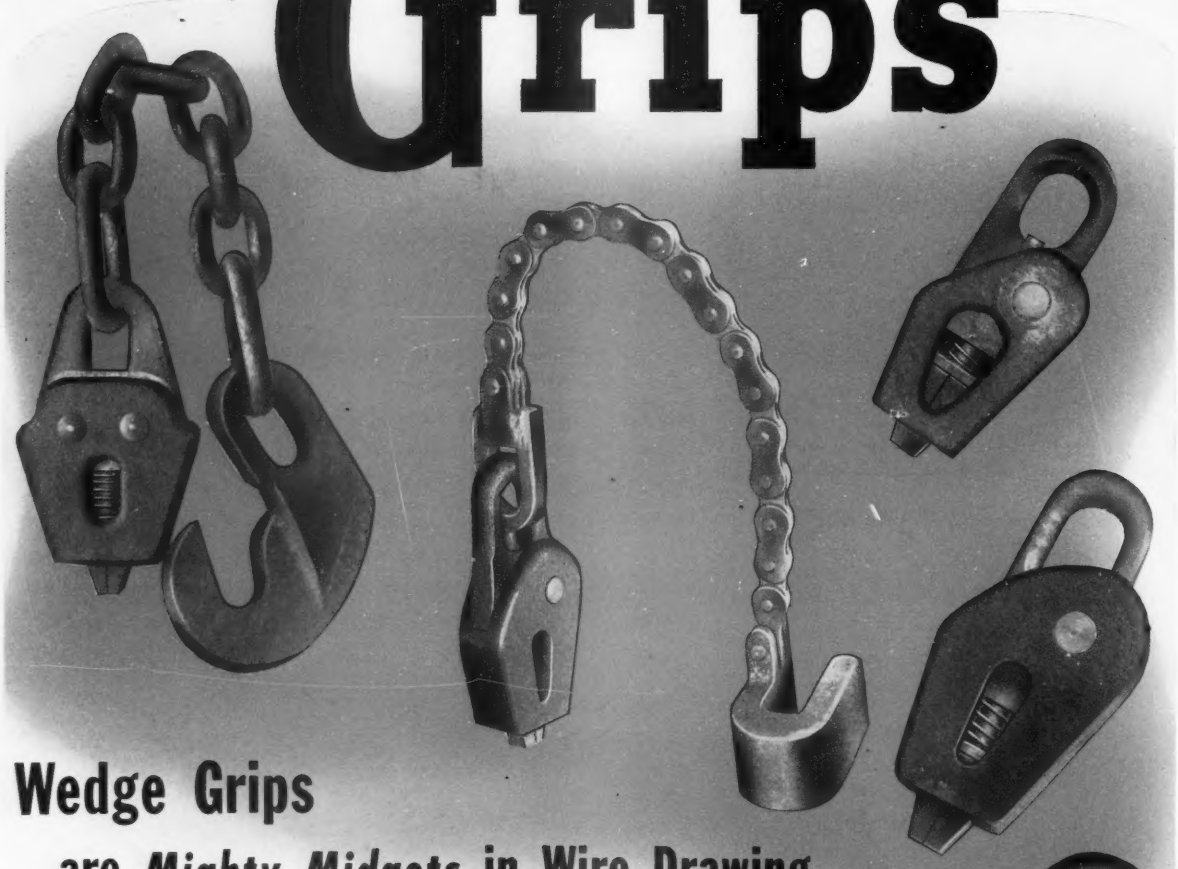
Grips



Wedge Grips
are *Mighty Midgets* in Wire Drawing

MORGAN Wedge Grips are timesavers. *First of all,* they employ a powerful wedge action which closes and holds the two Wedge Jaws against the point. The harder the pull the tighter the grip. *Second* — the Grip can be taken off the work quickly and easily. *Third* — each Morgan Wedge Grip is compact and can easily be pushed onto the point with one hand.

Morgan Wedge Grips are made in several sizes, each with a wide range of gripping capacity. Hardened tool steel Jaws and other parts are readily replaceable. Morgan Construction Company, Worcester, Massachusetts.

W-64

Continuous Wire Drawing Machines • Take-up Frames • Horizontal Bull Blocks • Vertical Spindle Bull Blocks • Pointers • Reels • Grips and other Wire Drawing Accessories

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MORGAN WIRE DRAWING MACHINERY

WIRE AND WIRE PRODUCTS

A monthly publication devoted to the production of Wire, Rod and Strip, Wire and Rod Products and Insulated Wire and Cable

DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 18 APRIL, 1943 No. 4

Designated as

Official Publication By The Wire Association

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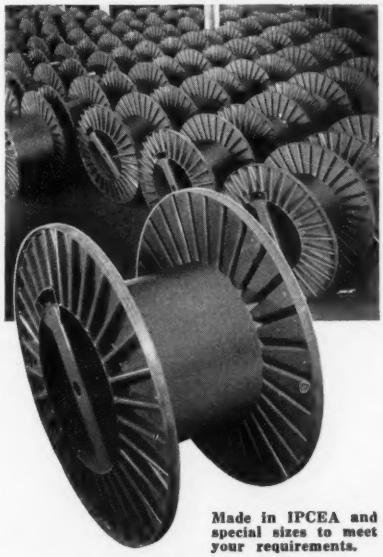
LOW-TARE Shipping Reels *and* Flanged Steel Traverse



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FIRTHALOY WIRE DIES...

Photo by courtesy of Pittsburgh Steel Company

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WIRE AND WIRE PRODUCTS

A monthly publication devoted to the production of Wire, Rod and Strip.
Wire Products and Insulated Wire and Cable.
DRAWING --- ROLLING --- EXTRUDING --- FORMING --- FABRICATING

Vol. 18 APRIL, 1943 No. 4

Steel Conductors for Transmission and Distribution of Electric Power

By Frederick M. Crapo,
President, Indiana Steel & Wire Company,
Muncie, Indiana.

THE war emergency, which has created shortages of the more critical conductor materials, has focused attention on the practicability of steel wire for transmission of electric power. The use of iron or steel wire for the transmission and distribution of electric power involves many problems which generally have not been fully appreciated.

✦ ✦ ✦

IF electric power were transmitted principally by means of direct current, the selection of the best iron or steel to conduct this current with the minimum loss would be simple. Iron, like copper and aluminum, has its best electrical conductivity for direct currents when the fewest impurities are present; that is to say, the purer the iron the better the conductivity for direct currents.

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HOWEVER, practically all electric power is transmitted by means of alternating current, being generally 60 cycles per second, occasionally 25 cycles and, in some instances, 50 cycles. In an alternating-current conductor the polarity or direction of the current changes twice per cycle, that is, from negative to positive and then from positive to negative, which means 120 reversals in direction for each second of elapsed time. This is illustrated by the sine-wave curve shown in Fig. 1. At the point A in the diagram the current flow is at its highest positive value. Then, following the curve to the right, in the next 1/240 of a second the current flow has dropped to zero, and at that point reverses its direction. Following the curve still farther to the right, to point B, the current there reaches the maximum negative value in another 1/240 of a second. Continuing to follow the curve another 1/240 of a second, the current flow is again zero, and about to reverse its direction again; then, after the fourth 1/240 of a second, at point C, the current has again reached its highest positive value, 1/60 of a second after A.

FREDERICK M. CRAPO

President, Indiana Steel & Wire Company, Muncie, Indiana. Inventor of Crapo Galvanizing Process. Responsible for development of steel conductors which bear his name. Graduated 1919 at Rose Polytechnic Institute as Bachelor of Science. Took post-graduate work at Massachusetts Institute of Technology. Joined the Indiana Steel & Wire Company in 1923 as chief engineer and, in 1927, became vice-president in charge of manufacture. Succeeded to the presidency in 1940 upon the death of the company's founder, the late Alva L. Kitselman. Member of The Wire Association, American Institute of Electrical Engineers, American Society for Testing Materials, American Society of Metals, American Welding Society, and American Standards Association.

Designated as Official Publication by the Wire Association

WHENEVER electric current flows through a conductor a magnetic field is formed or generated around the outside and inside of the conductor. If the amount of current flowing is changed the intensity of the field will change and, if the current flow is reduced to zero, the magnetic fields will die out or collapse. Then if current flows through the conductor in the other direction a magnetic field will be generated in the opposite direction. This is illustrated in Fig. 2, which shows the cross-section of a cylindrical conductor perpendicular to the paper. At A the current is assumed to be flowing away from the observer (or toward the paper) and the magnetic field is shown by the outside circles, with the direction of the field in right-handed rotation. At B the current is flowing toward the observer and the direction of the magnetic field is reversed.

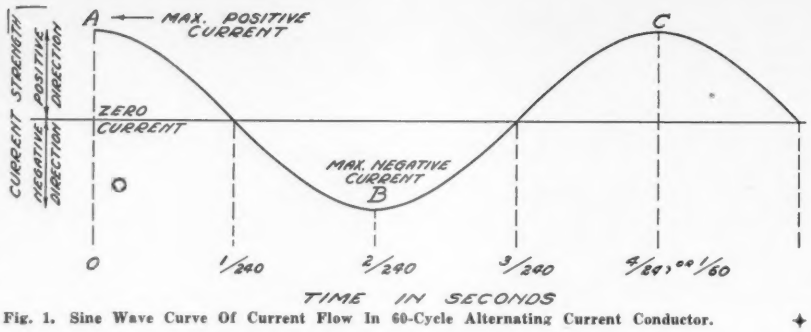

Fig. 1. Sine Wave Curve Of Current Flow In 60-Cycle Alternating Current Conductor.

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WITH a 60-cycle alternating current flowing through a conductor the 120 reversals of current direction per second cause the magnetic field or lines of flux inside and outside the conductor to be built up and collapse 120 times per second. If the conductor consists of a non-magnetic material, such as copper or aluminum, there is comparatively little opposition or impedance to the building up and collapsing of these magnetic fields. However, if the conductor consists of a magnetic material, such as soft iron or steel, appreciable energy will be required to build up and reverse these fields.

Skin Effect With Alternating Currents

THE magnetic fields inside of a conductor are indicated in Fig. 3, which shows the shape and direction of the internal lines of flux. However this flux at any given instant of time is not uniform in density over the cross-section, but ranges between zero density at the exact center or axis of the conductor and a maximum density at the surface or periphery. These internal magnetic fields build up from zero to a maximum and collapse again to zero in each half cycle of current, and also reverse their direction at the end of each half cycle. Consequently they induce counter-electromotive forces in the conductor which oppose the instantaneous changes of current. These internal counter e.m.f.'s do not affect the current at all parts of the cross-section with equal intensity, but exert the most effect on the current at the exact center of the conductor and the minimum effect on the current next to the surface. The consequence of this is that the impedance offered to the current by such a conductor is not distributed uniformly over the cross-section, but the impedance is greatest at the center or axis of the wire, and decreases gradually toward the surface, where it reaches a minimum. The final result is somewhat the same as though a wire were made of a material which did not have uniform resistance all over its cross-section, but the resistance increased with the distance or depth from the surface and became greatest at the center.

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THIS non-uniform distribution of impedance over the cross-section of the wire starting with a minimum at the surface and increasing progressively with deeper penetration to a maximum at the center, has the obvious result of distorting the internal current distribution. Hence the current density is least at the axis and greatest at the surface. For this reason the conductor apparently offers more resistance to alternating currents than it does to direct currents, because the latter have to overcome only the true resistance, which is uniformly distributed over the cross-section and thus permits full penetration of the current to all parts of the wire. This skin effect increases with greater intensity of internal magnetic flux, which in turn becomes greater with increased magnetic permeability of the wire material and also increases with the current. The skin effect also increases with the frequency of alternating current. The increase in skin effect which accompanies increase in current approaches a

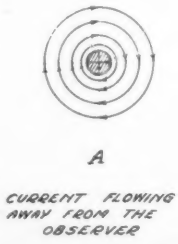

Fig. 2. Magnetic Fields Surrounding A Cylindrical Conductor. ✦ ✦ ✦

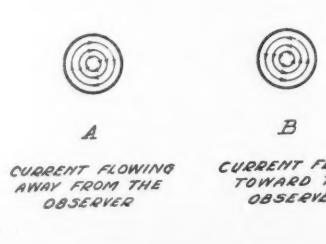

Fig. 3. Magnetic Field Inside Of A Cylindrical Conductor. ✦ ✦ ✦ ✦

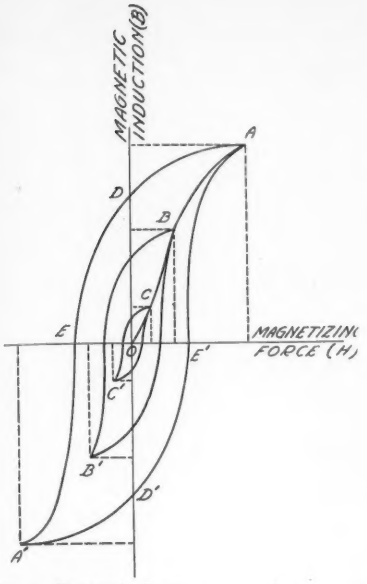

Fig. 4. Hysteresis Loops.

maximum when the magnetic permeability of the material reaches its maximum. At still larger values of current the skin effect tends to decrease, but not as rapidly as it rose initially.

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Hysteresis Loss

WHEN a magnetic field is built up initially in a material such as iron during the first half of a cycle of alternating current, it does not die out or collapse upon the return of the current to zero. The field decreases, however, but does not return to zero until the current has been reversed and then built up sufficiently to overcome what is termed the residual magnetization. As the current builds up to a maximum in the opposite direction during the second half cycle and then decreases again to zero, the phenomenon is repeated. This is illustrated in Fig. 4, where the curve of initial magnetization is shown as O C B A. Then at A the magnetizing force (proportional to the current) commences to decrease and when it has returned to zero again the magnetic induction has not fallen to zero but only to D. Then in the second half cycle the magnetizing force is reserved and when it has risen to O E the magnetic induction has been forced down to zero. As the current increases still more the magnetic induction reverses and then rises rapidly to A′ where it is equal but opposite to A. Then as the magnetizing force (and the current) again falls to zero, reverses, and once more rises to A. the magnetic induction follows the curve A′ D′ E′ A. This loop A E A′ E′ is repeated with each cycle of current and represents a loss of energy in the iron, which is given up as heat.

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IF the permeability of the material is relatively low, the magnetic induction established by a given current is also much less, and this reduces the area of the hysteresis loop, which expresses the fact that the hysteresis loss is likewise much less. The energy loss caused by hysteresis in a conductor becomes evident as an apparent increase in resistance, and therefore it produces a result similar to that caused by skin effect just described, but is an entirely different phenomenon. Both forms of internal loss, skin effect and hysteresis, become less as the magnetic permeability decreases, but this requires special steel and special processing to obtain satisfactory results.

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Improved Steel Conductors Much Superior to Iron

GALVANIZED E.B.B. Telephone Wire has the lowest electrical resistance for direct currents of any commercially produced iron or steel wire, and many engineers formerly considered it the best ferrous conductor obtainable for 60-cycle power lines. This wire, however, is a poor conductor for alternating currents as is shown by the graph of Fig. 5. The direct-current (D-C) resistance for a No. 6 E.B.B. wire with currents of 1 to 10 amperes is shown by the lower line of the graph. It will be noted that there is practically no change in resistance as the current increases.

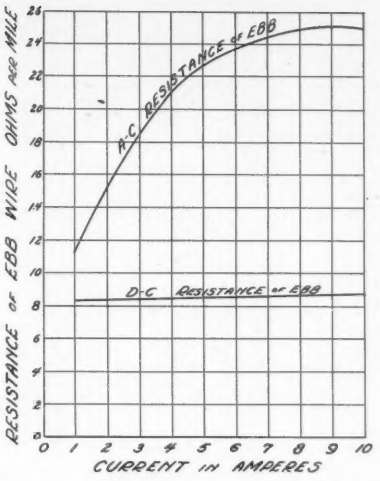

Fig. 5. Resistance Of No. 6 BWG E.B.B. Telephone Wire, When Transmitting 60-Cycle Alternating Currents And Direct Currents Of 1 To 10 Amperes.

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NOW note the upper curve of Fig. 5. When this E.B.B. wire is transmitting 60-cycle alternating currents its resistance is much greater than when transmitting direct currents. With a 60-cycle current of 2.5 amperes the resistance is double the direct-current resistance. With a 60-cycle current of 7 amperes the resistance is al-

TABLE 1
Physical Properties of HTC-130 Steel Conductors
(Copyright 1938, 1943 by Indiana Steel & Wire Co.)

Conductor Size B.W.G.	Type of Construction	Number of Wires	Diameter of Conductor (in.)	Cross-section		Approximate Weight		Minimum Breaking Strength (Pounds)
				Circular Mils	Square Inches	Lb. per 1000 Ft.	Lb. per Mile	
4	3-Wire	3/.138	0.297	57,132	0.04487	156	823	5610
6	3-Wire	3/.117	0.252	41,067	0.03225	112	590	4295
8	3-Wire	3/.096	0.207	27,648	0.02171	75	396	2915
4	Solid	1	0.238	56,644	0.04449	154	811	5784
6	Solid	1	0.203	41,209	0.03237	112	590	4208
8	Solid	1	0.165	27,225	0.02138	73.5	390	2780

TABLE II—Resistance and Reactance of HTC-130 Steel Conductors
(Copyright 1938 by Indiana Steel & Wire Co.)

Conductor Size BWG	Current (Amp.)	Resistance: Ohms per Mile	Reactances*; Ohms per Mile at Spacings Shown Below				
			24 in.	36 in.	48 in.	60 in.	72 in.
Stranded (3-Wire) Conductors							
4	1.0	8.07	1.35	1.40	1.43	1.46	1.48
	2.5	8.20	1.36	1.41	1.44	1.47	1.49
	5.0	8.39	1.40	1.45	1.48	1.51	1.53
	7.5	8.60	1.43	1.48	1.51	1.54	1.56
	10.0	8.83	1.48	1.53	1.56	1.59	1.61
6	1.0	11.29	1.37	1.42	1.45	1.48	1.50
	2.5	11.31	1.38	1.43	1.46	1.49	1.51
	5.0	11.36	1.42	1.47	1.50	1.53	1.55
	7.5	11.43	1.45	1.50	1.53	1.56	1.58
	10.0	11.53	1.50	1.55	1.58	1.61	1.63
Solid Conductors							
4	1.0	8.25	2.12	2.17	2.20	2.23	2.25
	2.5	8.44	2.30	2.35	2.38	2.41	2.43
	5.0	8.77	2.66	2.70	2.74	2.77	2.79
	7.5	9.18	3.13	3.18	3.22	3.24	3.27
	10.0	9.83	3.65	3.70	3.73	3.76	3.78
6	1.0	11.37	2.14	2.19	2.22	2.25	2.27
	2.5	11.48	2.32	2.37	2.40	2.43	2.45
	5.0	11.76	2.67	2.72	2.76	2.79	2.81
	7.5	12.26	3.15	3.20	3.24	3.26	3.29
	10.0	12.87	3.69	3.74	3.77	3.80	3.82

*Per mile of each conductor of a single-phase, two-phase or three-phase circuit, with the conductor spacings (center-to-center) shown above.

most three times the direct-current resistance.

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AT the time of World War I, the **Indiana Steel and Wire Company** began a study of the uses of iron and steel wire and strand for electric power conductors. The results of some of this early work were published in 1921 and again in 1923 and this data has been quoted many times in electrical engineering handbooks, text books, etc.

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SINCE that time, **Indiana Steel and Wire Company** has continued research on the use of steel as a conductor and about seven years ago introduced a new steel wire developed specifically for use as a conductor of alternating-current electric power transmission. This is designated as Crapo HTC-130 Steel Conductor. The physical properties of both the solid and stranded (3-wire) conductors are given in Table I. This wire has a high tensile strength and relatively low electrical resistance for alternating currents.

THIS Steel Conductor is manufactured from a medium-carbon steel of special composition, which is given special treatments during processing so that the permeability and skin effect have been reduced to unexpected small amounts. Comparisons of the a-c electrical resistances of solid and stranded (3-wire) No. 6 BWG HTC-130 Steel Conductors to those of solid E.B.B. and B.B. telephone wires of the same size are shown in Fig. 6.

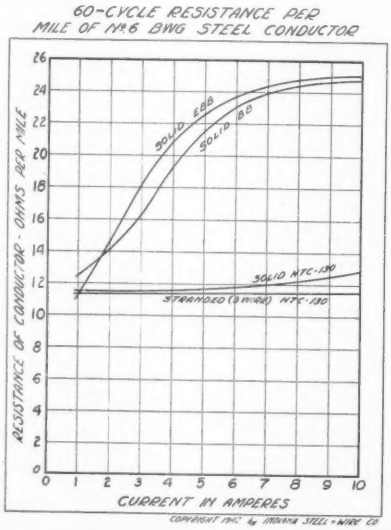
60-CYCLE RESISTANCE PER MILE OF NO 6 BWG STEEL CONDUCTOR
RESISTANCE OF CONDUCTOR - OHMS PER MILE
CURRENT IN AMPERES
SOLID EBB
SOLID BB
SOLID HTC-130
STRANDED (3 WIRE) HTC-130
0 1 2 3 4 5 6 7 8 9 10
0 2 4 6 8 10 12 14 16 18 20 22 24 26
COPYRIGHT 1937 by INDIANA STEEL & WIRE CO

Fig. 6. The 60-Cycle Resistances Of HTC-130 Steel Conductors Of Size No. 6 BWG In Both Solid And Stranded (three-wire) Construction Compared With The Same Sizes Of Solid Iron Wires Of E.B.B. and B.B. Grades, With Currents Up To 10 Amp.

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THE top curve (marked "Solid EBB") of Fig. 6 is plotted from the same results as the 60-cycle resistance curve of Fig. 5. The two lower curves show the a-c resistance of the two constructions of Crapo HTC-130 Steel Conductors of the same size. From the curves of Fig. 6 it will be noted that for alternating currents of 5 to 10 amperes the special steel conductors have approximately twice the conductivity of an E.B.B. wire of the same size.

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Examples of Applications

TABLE II gives the electrical properties of these steel conductors. Table III is a table of kilowatt-miles which has been calculated for the convenience of distribution engineers in the design of electric power lines. The use of the latter table can be illustrated by assuming a 6900-volt single-phase circuit 5 miles in length, with No. 6 BWG HTC-130 Stranded (3-wire) Steel Conductor. It is desired to determine the load at 0.90 power factor that this line can carry with a voltage drop not to exceed 5 percent. Table III shows that this conductor, at 6900 volts single phase, 0.90 power factor and 5% voltage drop, has a capacity of 99 kilowatt-miles. (A kilowatt-mile is defined as one kilowatt transmitted one mile.) Then since the line is 5 miles long, it will deliver 99 divided by 5 or 19.8 kilowatts if the load is concentrated at the end of the line. If the load is uniformly distributed along the line, as is often approximated in rural distribution where there may be two or three farm homes per mile, the line can be twice as long and transmit the same total load with the same voltage drop at the far end. Table III is based on currents of 1 to 10 amperes and conductor spacings of 36 to 60 inches. If the current materially exceeds 10 amperes or the spacing is much greater than 60 inches, special calculations should be made.

KILOWATT-MILES for other voltages are directly proportional to the squares of the voltages and can be calculated from the values given in Table III. For example, it is desired to find the voltage drop for a load of 800 kilowatts to be transmitted 25 miles with 66,000 volts, 3-phase, 60-cycle current having a power factor of 0.80 and using No. 4 BWG Crapo HTC-130 Stranded (3-wire) Steel Conductor. In order to know whether the values in Table III are applicable, the current in each conductor should be calculated in order to ascertain whether it will be within the limit of 10 amperes or less. A load of 800 kilowatts at 0.80 power factor is (800/0.8) 1000 kilovolt-amperes or 1,000,000 volt amperes; 1,000,000 divided by 66,000 volts and then by 1.732 (since this is a 3-phase line) equals 8.75 amperes. Since the current will not exceed 10 amperes, the data shown in Table III are applicable.

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THE kilowatt-miles in this example are equal to 800 (kilowatts) times 25 (miles) or 20,000.

Fig. 7. Armor Tie On Pin-Type Insulator. ✦

The ratio of the line voltage (66,000) to the voltage specified in Table III (12,000) is 66/12 or 5.5 and the square of this ratio is 30.25; therefore the kilowatt-miles of this line at 1% drop will be 154 times 30.25 or 4659 and the drop at 20,000 kilowatt-miles will be 20,000/4659 which equals 4.3%.

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THE foregoing are simple illustrations of the use of design data which transmission engineers require for the proper electrical design of transmission lines which are not too long to permit disregard of the line charging current without material error.

TABLE III—Kilowatt-Miles of 12,000-Volt Three-Phase and 6,900-Volt Single-Phase Circuits of Stranded (3-Wire) HTC-130 Steel Conductors
(The voltages are those delivered at the end of the line)
(Copyright 1940 by Indiana Steel & Wire Co.)

Conductor Size BWG	Percent Voltage Drop	At 12,000 Volts with Three-Phase Balanced Loads and Following Power Factors			At 6,900 Volts with Single-Phase Loads and Following Power Factors		
		1.00	0.90	0.80	1.00	0.90	0.80
4	1	174	160	154	29	27	26
	2	348	321	307	58	53	51
	3	522	481	460	87	80	77
	4	697	641	613	116	107	102
	5	870	801	765	145	134	128
6	1	126	119	115	21	20	19
	2	253	237	230	42	40	38
	3	379	357	344	63	59	57
	4	505	474	458	84	79	76
	5	631	593	571	105	99	95

Extensive Experiments Preceded Introduction

IN addition to the electrical problems, the use of steel conductors in out-door overhead transmission lines involves many mechanical problems including methods of conductor support, conductor fastenings, line taps, splices, dead-ending, determination of sags and tensions, etc. In order to study some of these problems, especially those due to conductor vibration, an experimental line approximately one-half mile long was erected at an exposed location. This line had spans of equal lengths which were changed from time to time, ranging from 400 to 800 feet. An electro-magnetic pick-up was designed for measuring the amplitude and frequency of vibration of the conductor. Continuous chart records were made of wind velocity, wind direction, wire tension, amplitude and frequency of vibration. Some of the recording meters and apparatus were placed in a small portable house which could be moved along the test line. Adjacent to this portable house was a platform of adjustable height from which the pick-up could be serviced. The experimental line was maintained under test and observation for about two years.

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Development of Construction Practices

IN addition to this out-door test a great many different types of mechanical tests have been made in the laboratory These tests include fatigue tests on the wire itself and on the wire in connection with various line-hardware fittings, ties, splices, etc. Tests also have been made to determine the holding power of suitable dead-end fittings, splices, etc.

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THESE numerous detailed studies have been necessary because the high tensile strength of these HTC-130 Steel Conductors will permit the use of unusually long spans. The use of such spans

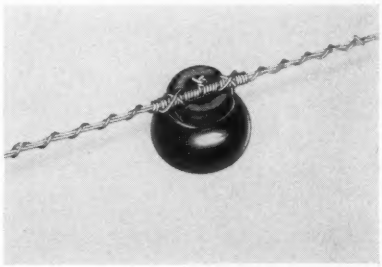

Fig. 8. T-Tie On Pin-Type Insulator. ✦

is very desirable, since obviously the cost of the line will be less if fewer poles are required. However this means that the weight of conductor carried at the point of support will be greater, and therefore the method for supporting the wire must be of such type that it will not concentrate too much stress at any one point, as this would tend to cause fatigue failures.

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A TYPICAL problem has been the design of a proper tie for fastening the steel conductor to the insulators. Two types of tie have been developed and have proven very satisfactory in service. These are the armor tie (Fig. 7) and the T-tie (Fig. 8). The first

is made of one length of tie wire; the second is made of two lengths of tie wire of slightly smaller diameter. Care should be taken in applying these ties to make sure that the tie wire is wrapped tightly around the conductor. The uniform spacing of the end wraps should be maintained, as wraps spaced too closely or too widely will defeat the purpose of the tie.

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SPLICING of this steel conductor has been another problem. The old-fashioned hand-wrapped joint or twist splice is not satisfactory. The high tensile strength of this conductor with its accompanying springiness will cause the wraps of such a splice to spring away from the wire, so that a tight splice cannot be made. Furthermore such a splice will not have the required strength or electrical conductivity.

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THE compression-type of splicing sleeve has proven most satisfactory. This splice consists of a short length of steel tube, the inside of which is only a little larger than the diameter of the wire. The end of one of the wires to be spliced is pushed half-way through the tube and then the tube is compressed or pinched tight onto the wire by using a compression tool. This tool is built similar to a bolt-cutter except that the jaws are flat and about 5/16-inch wide, with grooves for gripping and compressing the splicing sleeve. The end of the other wire is then placed in the opposite end of the splicing sleeve. Each compression of the tool only covers about 5/16-inch, so that several applications must be made along the sleeve. The first compressions should be adjacent to the center, as each compression causes slight elongation of the sleeve.

Fig. 9. Junction pole in 6900-volt, single-phase line with taps to farm homes on both sides of highway. Location, Grant County, Indiana. Conductor, No. 6 B.W.G. Stranded (3-wire) Crapo HTC-130 Steel Conductor.

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THE straight-line automatic type of splice is also used, especially for small jobs and for making emergency repairs. This type of splice is tubular in shape, but larger in diameter at the middle and tapered toward both ends. Inside the tube and suitably supported at each end are three to five wedge-shaped jaws which grip the ends of the wires when they are pushed through the holes at either outside end of the splice.

Fig. 10. Crapo Steel Conductor in rural primary distribution line in Texas. Spans in this line average 600 feet.

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ALMOST desirable type of fitting for a dead-end is half of a compression-type splicing sleeve, which is terminated in a clevis for attachment to a strain-insulator or (in case of a neutral conductor) an eye-bolt. A similar fitting is made by using half of a straight - line automatic splice, also fitted to a clevis. Either of these two types of dead-end fittings is preferable to clamps or spool type fittings.

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Sags and Tensions of Overhead Spans

WHEN a steel wire is hung between two points at equal elevations the suspended wire conforms to the curve known as a catenary. The significant quantities which need to be known in order to correctly design such an overhead span are the following: (1) Sag at center of span, that is the distance the wire is below a horizontal line passing through the two points of support; (2) maximum tension in wire; and (3) weight of wire (or wire plus ice and/or wind) per unit of length. If any two of these factors are known the third can be determined by using the formulas for the catenary.

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TEMPERATURE changes will cause the sag, and consequently the tension, to change because of the changed length of conductor between the supports. If the temperature increases, the length of wire between the two

(*Please turn to Page 244*)

Testing in the Metal Industry

By F. R. Morral

Assistant Professor of Metallurgy, School of Mineral Industries, Pennsylvania State College, State College, Penna.

The author presents an analysis of different types of testing and their applications in the metal industry, presenting a brief correlation of new methods of testing and his comments on some of them.

IN this War, as in no war before, Victory depends on quantity and quality of metals and their products. Lives of our young men depend on metals not only because they serve actively in the offensive—in the form of shells, bombs, etc,—but, the tools, accessories, and carriers are also made mainly of metals and their alloys.

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VARIOUS organizations and manufacturers have established specifications for quality. These are well known and have been published by the respective bodies, such as the **Federal Government**, the **Army, Navy. Aircraft, S. A. E., A. S. T. M., A. I. S. I.** and others.

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CONTROL is necessary throughout production, from raw material to the finished product to accomplish the specified quality. Control is useful also in production in terms of quantity. The modern metal industry is sold, because of goods received, on control. The control may be of two types: Recording and Non-recording, the first predominating. It is thus that the curious on walking through an open hearth department, for example, will notice temperature recorders of various types, which control automatic or semi-automatic valves which in turn control fuel and air; a barometer, which permits making adjustments of raw materials added, to control final composition before it is too late. An observer, who with his optical pyrometer measures the temperature of tapping steel, takes notes and records on a sheet the actual history of that particular heat of steel. Other records will be taken later as this steel goes through the various mills, where it will be fabricated. These records will indicate the performance and properties of the steel and therefore its suitability for a particular use.

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ONE of the types of non-recording control is that performed by the inspector, who looks at the article or even perhaps tests it either by hand or by visual examination and therefrom decides whether the product is of quality to go on to service. The melter on the open hearth floor examines the molten metal flowing from his spoon and judges its temperature and carbon content. Usually no record is taken of this data. Material being examined by radiography through a fluoroscopic screen is accepted or rejected on the face of its visual appearance on the screen.

F. R. MORRAL

Received B.S. degree Electrochemical Engineering, Massachusetts Institute of Technology 1932; Doctor of Philosophy, Purdue University, 1940. X-ray diffraction research on iron alloys, University of Stockholm and Metalografiska Institut, Sweden (1932-4). Metallurgical and electrochemical research. University of Barcelona. Spain (1934-36). Research Fellow, Purdue Universitw 1937-38; Research Metallurgist, Continental Steel Corporation, 1936-41; Assistant Professor of Metallurgy, The Pennsylvania State College, 1941 to date. Member: American Society for Metals; American Institute for Mining and Metallurgical Engineers; Electrochemical Society; British Institute of Metals; British Iron and Steel Institute; American Society for X-ray and Electron Diffraction, Sigma Xi.

✦ ✦ ✦

THE electroplating shop, a few years ago one of the sloppiest businesses in the metal industry, has cleaned up considerably and gone in for recording control, with such devices as the pH meter; water to be used in plating solutions is analyzed; current densities kept constant; etc.

✦ ✦ ✦

THE control of production may be localized in one department of the industry or its burden distributed throughout the plant. For the sake of comprehensiveness all control should be considered the responsibility of the men connected with the laboratory. The laboratory is a non-productive department. Its existence is justified only to the extent that it helps the company through its three definite functions:

a) **material control, (quality)**
b) **production control (quantity)**
c) **new developments (products, and processes)**

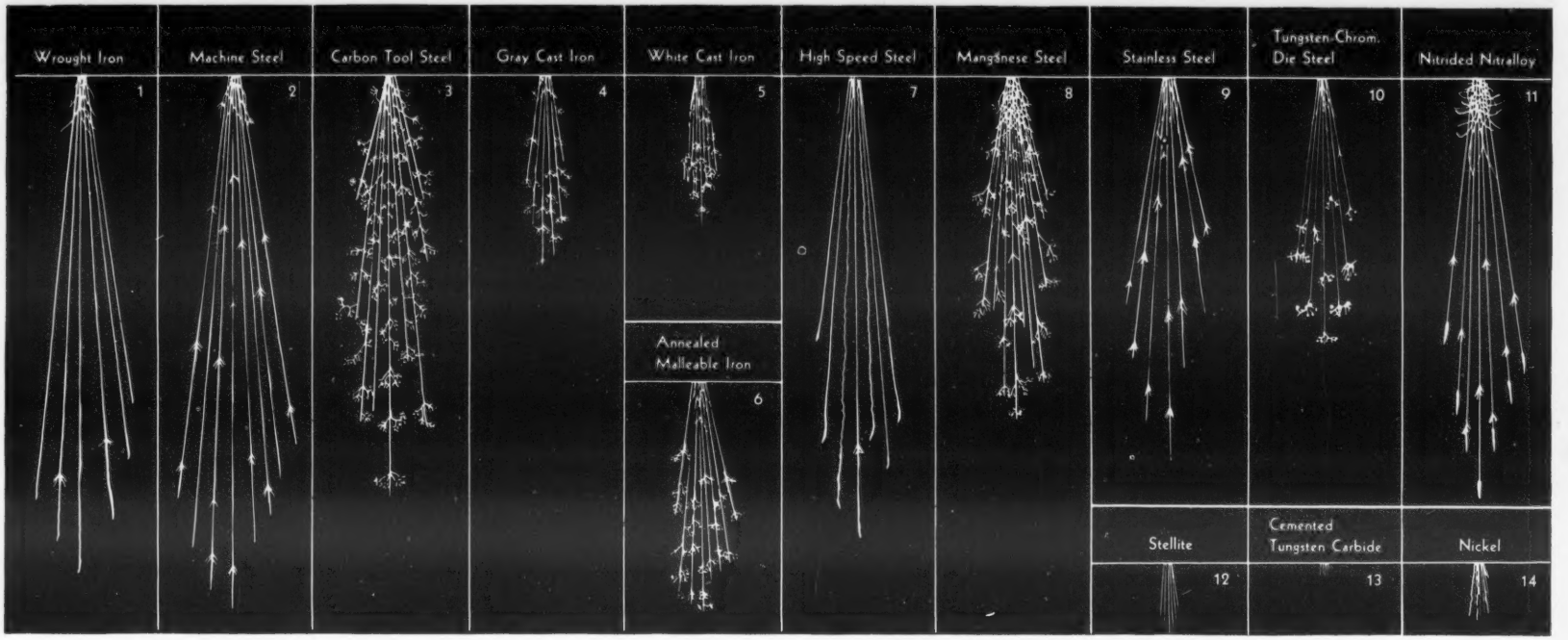
✦ ✦ ✦

BECAUSE of the needs of our men in the field it behooves the laboratory department to put to use all means to assure effectiveness in the three items mentioned above. New methods of testing or control which can be useful in industrial production must be brought to task, although up

Fig. 1

Spark Test for Metals

Reprinted from "Grits and Grinds" (Norton Co.), June 1940



Line	Metal	Volume of Stream	Length of Stream (a)	Color of Stream		Quantity of Spurts (b)	Nature of Spurts (b)	Line
				Close to Wheel	Near End			
1	Wrought iron	Large	65 in.	Straw	White	Very few	Forked	1
2	Machine steel	Large	70	White	White	Few	Forked	2
3	Carbon toolsteel	Moderately large	55	White	White	Very many	Fine, repeating	3
4	Gray cast iron	Small	25	Red	Straw	Many	Fine, repeating	4
5	White cast iron	Very small	20	Red	Straw	Few	Fine, repeating	5
6	Annealed malleable iron	Moderate	30	Red	Straw	Many	Fine, repeating	6
7	High speed steel	Small	60	Red	Straw	Extremely few	Forked	7
8	Manganese steel	Moderately large	45	White	White	Many	Fine, repeating	8
9	Stainless steel	Moderate	50	Straw	White	Moderate	Forked	9
10	Tungsten-chromium die steel	Small	35	Red	Straw (c)	Many	Fine, repeating (c)	10
11	Nitrided nitralloy	Large (curved)	55	White	White	Moderate	Forked	11
12	Stellite	Very small	10	Orange	Orange	None		12
13	Cemented tungsten carbide	Extremely small	2	Light orange	Light orange	None		13
14	Nickel	Very small (d)	10	Orange	Orange	None		14
15	Copper, brass, aluminum	None				None		15

(a) Figures obtained with 12-in. wheel on bench stand, and are relative only. Actual length in each instance will vary with grinding wheel and pressure.

(b) "Spurts" are the sparks (seemingly small explosions) that occur at intervals on the carrier lines.

(c) Spurts are blue-white.

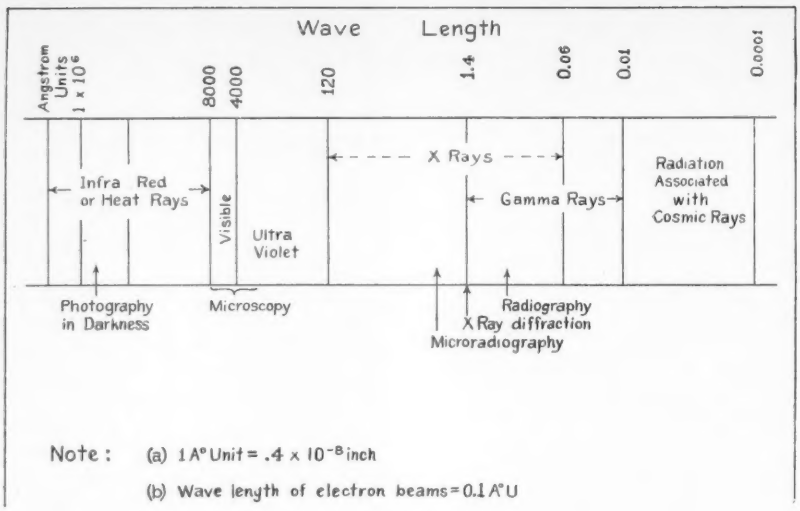
(d) Some wavy streaks may be observed.

TABLE II. DESTRUCTIVE TESTING USED IN METALLURGY

Method	Property made use of	Applications
a) Chemical Analysis		
Qualitative & Quantitative	Determine ions (Fe_2 Fe_3, SO_4) present	General chemical analysis, used for routine and special work.
Organic	Determine, C, H_2, O_2, N_2	and specific properties to analyze qualitatively and quantitatively organic compounds.
Spectrographic spectroscopic	Shows spectrum of "excited" elements	A micro-method, small amounts of sample necessary. Permits rapid determination of elements present in small amounts 3 to .0001 per cent and less. Limitations
X-ray diffraction Electron diffraction	Position and type of atoms give a typical spectrum	Used to identify compounds as such and elements. Analysis of mixtures possible if one present in smallest amount is at least 10 per cent.
Micro analysis	Special reactions	Use very small amounts of sample.
Electrochemical analysis	Deposit ions at cathode or anode	Rapid quantitative method using d.c. current.
Polarographic	Automatic recording of current voltage curves	Rapid quantitative and qualitative analysis.
Colorimetric	Light transmittance of solutions of various concentrations different	Various techniques have been developed. Use photoelectric cells to do actual measurements of transparency.
Polarized light	Differential coloring of compounds	Used in analysis of slags, also in metallography and special tests.
Magnetic & electromagnetic	Properties of metals and alloys vary	Used for rapid analysis of carbon in steels, etc.
Spark testing	Metals have different sparking characteristics	Used for identification of metals. Extensively used to estimate quantitatively analysis of alloying elements in certain steels.
b) Physical (or mechanical) Properties		
Tensile	Strength and deformation	Obtain values of engineering significance. Only test to give absolute values.
Micro-tensile	Strength and deformation	Micro samples.
Hardness	a) resistance to indentation b) resistance to scratching	Brinell, Rockwell & Vickers from file to microcharacter
Impact	Resistance to shock	a notch sensitive test; (very arbitrary)
Fatigue	Endurance	for materials subjected to varying stresses
Torsion	Resistance to twist	Shafts, rivets holding plates together
Bend	Alternate tension and compression	Wire, sheets, welds, etc.
Creep	Deformation of metals	In relation to time and temperature.
Damping	Internal friction and	Dissipation of energy within material.
Tear	directional properties	Particularly in sheets.
c) Metallographic (See Fig. 2)		
Macroscopy	Reflection of light from etched surfaces	Grain structure of metals and alloys at low magnification: visual to 5 X.
Microscopy	Reflection of light from etched surfaces	Metallographic structure of metals and alloys at magnification of 50-3000 X.
Microradiography	Absorbing power of metal constituents	Magnification 1 X, but can easily be enlarged to 100-250 X.
Electron microscope	Opacity to beams of electrons*	Metallographic structure of metals and alloys at magnifications of 5000-30000 X.
Diffraction a) X-rays	Diffraction	Atomic crystal structure, magnitude 10^{-8} cm., penetrate deeply (100 A. and more) Atomic crystal structure, magnitude 10^{-8} cm., penetrate lightly (up to 50A)
b) electron beam	Absorption of electro-magnetic radiation; (opacity) penetration depends on wave length	To determine homogeniety of material, flawlessness, etc. Usually natural size. Location of flaws.
Radiography a) X-rays b) gamma rays Stereo-radiography	ditto	Many of the methods mentioned in these tables are used to determine corrosion resistance of metals and alloys under controlled conditions in the laboratory, as well in the field in service.
Corrosion	Chemical affinity	
Hardenability	reaction to quenching of carbon and alloy steels	
a) Jominy end quench b) Shepherd P-F c) Burns, Moore & Archer S-A-C d) cathode ray oscillograph		

*Note: A special technique is required to obtain samples of metal structures for electron microscope examination.

to the present time they may have been merely toys or curiosities in the laboratory of the scientist. The physicists, chemists, physical chemists have developed tools and techniques very useful for their endeavors and studies, many of which have already shown their worth in industry. Other available methods should be brought to the attention of laboratory departments for their possible application.



✦ ✦ ✦

MATERIAL and production control is usually done through observation and testing. The men in charge of such work are called observers and inspectors on one side, and on the other side the laboratory men. The men in responsible positions have been trained as metallurgists, engineers and chemists. New developments result from the efforts of these men, and are usually sought by research metallurgists, engineers, physicists and others. Knowledge of fundamental principles, knowledge of the past and ingenuity bring about the new developments. Testing decides on their validity.

✦ ✦ ✦

IN general, the object of testing is to reveal:

1. **The chemical composition (or analysis)**
2. **The physical properties**
3. **The structure of metals and alloys (metallography)**

✦ ✦ ✦

MOST frequently one of the above three alone does not tell the whole story; all three must be closely correlated for metals.

PHYSICISTS and chemists have developed methods and techniques of testing very useful in their field. Some of these already have found their way to the laboratory of the metal industry. This is because of their ability to measure properties or conditions not possible to test before, or because they were decided improvements on previous methods. From now on it is the purpose of this paper to correlate briefly old and new methods of testing and to comment on some of the newer ones.

✦ ✦ ✦

TESTS may be classified into two large groups:

I. Non Destructive
II. Destructive

✦ ✦ ✦

Sampling

SAMPLING is extremely important but outside the scope of this article. Details about this phase of the work can be found

(*Please turn to Page 236*)

TABLE I. NON-DESTRUCTIVE TESTING

Method	Property made use of	Applications
	Chemical	
Spark test	Characteristic spark of metals	Classification and identifcation
Spot test	Metallo-organic reactions	Detection of metals
Electric eye	Sensitivity of photo-electric cell	Production of Bessemer Steel
Fluorescent lighting	Metal surface appearance changes	Selection of stainless steel, Mo, Ta and Ni scrap
Corrosion	Chemical affinity	Field test and pilot plant scale
	Physical	
Scleroscope	Rebound hardness	Finished parts, roller bearing ball
Stroboscope	High frequency light flicker	Stressed members in motion
Magnetic	Decrease in attraction of a permanent magnet for steel	Measure thickness of non-magnetic coating on iron or steel
Strain coat	Brittle lacquer	Strains on members
Acoustic	Transmission of sound	Stetoscope used on castings and welded structures
Ultra-sonic	High frequency sound	Detectoscope, ditto and large ingots
Magnetic (powder)	Maintain even flux	Surface cracks, non-metallic inclusion in castings, steel and cast iron, also in drawn, forged, pressed or rolled parts.
1. as such	a) cylindrical parts	
2. fluorescent	b) solid parts	(a) on magnetic; (b) on non-magnetic materials
Radiography	Penetration through	Examination of ferrous and non-ferrous castings and welds. For quality of products and to improve technique of production
1. X-rays	opaque bodies	
2. Gamma rays	15-1000 kilovolts	

De Profundis

By Kenneth B. Lewis,
Consulting Wire Mill Engineer,
Worcester, Mass.

Our reporter interviews Mr. J. J. Whoosis, the prominent industrialist in the Federal Penitentiary at Lewisburg, Pa. ✦ ✦ ✦ ✦ ✦

AFTER being searched by a turnkey I was led through the main cell block and ushered into the prison library, where I found Mr. Whoosis seated before an open fire in a deep leather-cushioned easy chair.

✦ ✦ ✦

Q. Good morning, Mr. Whoosis, how are they treating you?

✦ ✦ ✦

A. Fine, my boy, just fine. I came in here with a doctor's certificate and a bunch of electrocardiagraphs, and the warden, who's not a bad chap, put me in charge here. Matter of fact, almost my only duty is to keep the dust off these cushions.

✦ ✦ ✦

Q. Isn't the inactivity a little irksome, after your strenuous life?

✦ ✦ ✦

A. No, not a bit. I am taking advantage of the situation to whip my book into shape.

✦ ✦ ✦

Q. Oh yes—the book. That's one of the things my editor wanted to know about. Can we give you a little publicity? What's the name going to be?

✦ ✦ ✦

A. I haven't fully decided between "Mein Kampf" and "A Natural History of the New Deal."

✦ ✦ ✦

Q. Well, I'll probably get slugged for this, but are you going to soak us like you did for the Bonzel?

✦ ✦ ✦

A. I resent that. You have no idea what it costs to publish a technical book for a small market. I was very lucky to get my bait back, and by the way sonny, if you've got a copy hold it for a rise. The edition is about gone, and the plates have been melted for cartridge cases.

Q. May I compliment you on the snappy uniform?

✦ ✦ ✦

A. Thanks son. The stripes are a little more pronounced than I have been accustomed to, and I don't think a horizontal pattern does justice to my figure, but it's nice and loose under the arms, and that's the main thing. My predecessor must have been a heavyweight wrestler.

✦ ✦ ✦

Q. Mr. Whoosis, speaking on behalf of the members of the Wire Association, I wish to convey to you our deep sympathy in your mis—

✦ ✦ ✦

A. Here, here, what's all this? Do you mean to say that you have the impertinence to be sorry for me?

✦ ✦ ✦

Q. No offense, Mr. Whoosis, but after all, you're in a Federal Pen.

✦ ✦ ✦

A. Well, aren't we all? The only difference is that you others haven't got a roof over yours, and you have to pay your own expenses. Why, when I think of my good fortune I could break out into song. Here I am in the good old Republican state of Pennsylvania, when I was dead sure they would send me to Atlanta with the bootleggers and the dope peddlers. You meet a very fine class of people here, my boy. For instance, do you know who has the apartment right next to mine? A fellow who's doing a long stretch for threatening the President. He introduced himself to me by banging on the bars in Morse Code, which I learned when I was a scoutmaster.

✦ ✦ ✦

Q. How interesting.

✦ ✦ ✦

A. Yes, He's a fine intelligent and ambitious young fellow. I'm teaching him Spanish in my spare time.

✦ ✦ ✦

Q. Mr. Whoosis! Don't tell me you can teach him Spanish by banging on the cell bars in code!

✦ ✦ ✦

A. Certainly not. Do apply your mind, my boy. Didn't you ever read "The Count of Monte Christo?"

✦ ✦ ✦

Q. Good God—do you mean to say you are digging a tun----.

✦ ✦ ✦

A. Hush — button your lip — lower your voice. That thing you see up on the wall is not an oil painting of W. C. Fields; it's the warden looking through a peephole, and his ears are quivering like a rabbit's.

✦ ✦ ✦

Q. How far have you got?

✦ ✦ ✦

A. Well, if my calculations are correct, and I think they are, you know me, we are just passing under Trenton, N. J.

✦ ✦ ✦

Q. A tremendous undertaking, Mr. Whoosis, and one that thrills me to the marrow. But tell me—what do you do with all the dirt?

✦ ✦ ✦

A. I'm glad you asked that, my boy. Every two hundred yards we have run a short side-galley, opening into a large circular room, in which we have dug a deep pit, and there we dump the dirt.

Q. But Mr. Whoosis, what about the dirt from the pit?

✦ ✦ ✦

A. We make the pit deep enough to hold that too.

✦ ✦ ✦

Q. Well, I'll probably get slugged for this, but I don't see how you can—

✦ ✦ ✦

A. Sorry, my boy, not being a consulting engineer, you wouldn't understand that. Just think of it as one of the secrets of the profession. My patent lawyers would never forgive me if I said any more. Now tell me, what is it you want? Not that you're not always welcome, you know that, but I know **Dick Brown,** and he wouldn't pay your fare to Lewisburg just as a gesture of sympathy.

✦ ✦ ✦

Q. Well, yes, sir, you're right. My editor says he knows that you enjoyed a personal acquaintance for many years with President Roosevelt, and he wants me to ask you to explain just how he got to be the way he is.

✦ ✦ ✦

A. I resent that word enj--, oh never mind, skip it. He's technically correct, and I'll be glad to explain it, if you're not in a hurry. Take that Morris chair, and help yourself to a cigar. Put a couple in your pocket — go on — it's all right, they belong to the warden. That's the box he keeps for the Governor. He thinks I've been forbidden to smoke—ha ha!

✦ ✦ ✦

NOW lean back, close your eyes, relax, and imagine the calendar has been turned back about a thousand years. You find yourself in England, let us say in Worcestershire, not far from the Welsh border. Let us say your name is Ancestor, George W. Ancestor. You are a healthy vigorous knave, a good provider, hot tempered, and handy with the bill-hook and the battle-axe. You have a neat little stone shanty, wife, kids, a few acres hacked out of the forest and planted to wheat and cabbages, a couple of hogs, and a trap line in the woods.

THE neighbors respect your superior thrift, strength and courage, and a certain clever upper-cut with the battle-axe. When the tough gangs from the other side of the tracks come over to raid their melon patches they always yell for you and you always come on the run, because you love a good scrap. They slip you an occasional rabbit or pheasant, or watermelon. They fall into the habit of coming over to your shack Sunday mornings and asking you to settle their little disagreements. You might call yourself the mayor of the town, if there was a town, and if you knew what a mayor was.

✦ ✦ ✦

ONE day the King rides past and stops for a chat. "George", he says, "I've been watching you down here in Abergavenny, don't think I haven't, and I don't mind saying I like the way you're handling the situation. I haven't been in a position to say anything; you probably know I've been pretty busy along the north border, but things are looking better there now, and I'm free to take up the situation over here. Are you open to a proposition?"

✦ ✦ ✦

"GO ahead" says George, "I'm listening."

✦ ✦ ✦

"WELL" says His Majesty, "I need a good man right here, to be on the spot and look after my connections, and it's something you could handle. Here's my proposition. I'll make you the Marquis of Sire, give you two hundred stands of arms, spears, battle-axes, and of course muskets after they've been invented, lend you three hundred horses, and I'll lend-lease you this whole damned county to handle any way you want, lock, stock, and barrel, man, woman and child, right down to the squirrels in the trees. The rent will be nominal. Now you know these tough cookies have been coming over here from Wales and pestering my people, walking off with a couple of fat hogs and a cart-load of turnips, and every once in a while they knock off a couple of my loyal subjects. YOU've been doing a nice job on them, and things are pretty quiet right here, but I want you to take in more territory—in fact, cover the border all along the county line.

✦ ✦ ✦

AND another thing. Right over in the next county is Hubert, whom I have just made Baron Rumbottle. Give him a hand if he gets in a jam, and he'll do the same for you. Now this is going to take a lot of your time, and you won't be able to hoe the cabbages or slop the hogs. Let that go. Just draw on these yokels for whatever you need, food, drink, labor, service of any kind. They belong to you. Tax them whatever you want. I'll take my percentage of course, but outside of that, it's all yours. Any time they really gang up on you, you holler and I'll come a-running. You look after my interests and I'll be right back of you. How about it?"

✦ ✦ ✦

WELL, they sit down and dicker for a while over percentages, but the deal goes through about as proposed, with the addition of the courtesy title of Viscount for George's oldest son. George kisses the King's hand, a keg of mead is tapped, and little Brunhilde trips in and hands the King a bunch of pansies as nominal rent, and a symbol that the land and all its produce is theoretically his. And that's that. The feudal system has started.

✦ ✦ ✦

THE curtain is now lowered, to denote the lapse of several centuries. As it rises again, we see that the current Marquis has got a real cute little castle, with all the modern improvements, turrets, watchmen, pitchkettles, draw-bridge, moat, dungeon and all like that. No plumbing, of course, but a sturdy six-holer out back, that has a range of two miles on a clear day. We find Cedric, seventh Marquis of Sire, seated in his library, a commodious apartment furnished with three books and a hogshead of ale. Cedric is brooding. It seems that

a few miles away there is a "town" a new development in English life. Some scurvey knaves among the tenants had developed special aptitudes in handicraft, and instead of doing part time work for their families, or joining the castle staff, these damned tailors and shoe-makers and blacksmiths had put up a huddle of shacks on some waste land and were peddling their stuff to the tenants. And the tenants were bootlegging food to them.

✦ ✦ ✦

CEDRIC began to wonder whether his father had been wise to grant exemptions and privileges to these oafs. He felt they were getting a bit out of hand. He had just ridden through their town, and while they did touch their hats in a grudging way, he detected what he considered to be dirty looks, and as he rode away he could swear he heard a faint razzberry. And all that over a bit of taxes! Worse than the bootlegging was a rumor that a Jew had settled nearby and had invented money, and the tenants and the townsmen were trafficking in this unsanctified stuff. Cedric felt that there was a spirit abroad in the land that boded ill for the future of England.

✦ ✦ ✦

TO him there entered, preceded by hearty curses, his son, Viscount Breeders, nursing a black eye, and with one ear full of tomato seeds. All the Marquis could get out of him was the fact that he had been in the "town", and the opinion that there was a spirit abroad in the land that boded ill for the future of England. The Marquis ventured the opinion that certain sanguinary tradesmen were getting a bit above themselves, and the Viscount agreed. This marked an epoch, being the first time these two had agreed about anything since the Viscount came of age. They split a flagon of ale, and agreed further that certain unsanctified varlets would be brought to heel, or by Saint Brigid of Cwmbran they would bloody well be ridden down by cavalry. The good Lord had established an upper class and a lower class, they agreed, and by Saint Athelstan of Whiffletree there was no place for anybody in between.

✦ ✦ ✦

AGAIN the curtain falls, to denote the passing of a few more centuries. As it rises we see that the castle has attained noble proportions, and is surrounded on all sides by messuages, hereditaments, pergolas, and miscellaneous shrubbery. Eustice, eighteenth Marquis of Sire, is seated in his library. Eustace is brooding. In fact Eustace has got the hump. It's this blawsted middle class that has got Eustace down. It seems that there was an industrial revolution some time back; some impertinent busybody up in the Midlands had invented a steam engine. Like a pestilence there broke out a whole series of machines that would spin, weave, and all that stuff, more than hundreds of men. These machines permitted, nay, even required, industrial organization on a grand scale. Cottage industry was out; large sums of money had to be raised, buildings erected, working capital found. What griped Eustace was that these scabby rats of the middle class had raised it, and it was paying off in a big way. The apple-knockers were slipping out of the tenant class to become mill hands, and out of the mill hands were climbing more candidates for the middle class. The feudal system was cracking up; capitalism was raising its ugly head!

✦ ✦ ✦

FINANCIALLY Eustace was in the pink, for it seemed these steam engines need coal, and the coal was found in the outlying sections of Sire park. Eustace was taking a nice cut. But what got Eustace down was that these middle class magnates were getting a bit above themselves. They were pulling out of the towns and putting up large mansions too damned close to Sire Towers, and too damned handsome and elaborate for Eustace's taste. Ostentatious, Eustace called them. These upstarts had begun to compete with Eustace for butlers and footmen. Their sons and daughters were beginning to crash the gates among the minor nobility. Their grandchildren were entered at the best public schools and were found at Oxford and Cambridge. Some of them were angling in the most brazen way for titles, and, hell's bells, some of them were getting them! There is a spirit abroad, thought the eighteenth Marquis, that bodes ill for the future of England.

✦ ✦ ✦

WHEN in this mood, the Marquis always found it comforting to make the rounds of the tenant farms. The humility, obsequiousness, and politeness of the lower class never failed to sooth his exacerbated nerves. The tenants were contemptuous of the tradesmen of the town. They had known most of them when they couldn't make change for sixpence, and here they were, bold as brass, setting up to be gentlemen! Next you knew they'd be offering to take tea with 'is Lordship! What the world was a-coming to they'd assure you they didn't know.

✦ ✦ ✦

LATER the Marquis discovered, to his amazement, that he had points of contact with the mill hands. They both hated the middle class industrialists. They both felt the competition of that class though in different ways. They came to believe that it was the Capitalistic System that they hated. Actually it was the capitalists personally, who were pushing in on the upper class, and stepping on the faces of the lower class in the process. An idea took possession of Eustace. "See here, my good fellows" he said to the miners union, "you stand by me and I'll stand by you, and we'll show these bleeding capitalists where to head in. I'll represent you in the House of Lords, and we'll tax and harry the little blighters till they won't know which way to turn."

✦ ✦ ✦

AND so we find today the puzzling paradox of a strong Labor party in the House of Lords, as well as in the Commons. Lord Picklepuss gets up and bellows (in a nice way, of course) about the rights of the common man, and the evils of the capitalistic

system. He really means it. He still owns the acres, and if capitalism went to pot he figures he'd just slip back into the good old feudal system, and tax the tenants in pigs and flour and potatoes. What do the lower classes think, you ask? Hell, what would they think with?

✦ ✦ ✦

PARDON me, son, am I keeping you up?

✦ ✦ ✦

Q. No, not at all, not at all. I am enjoying your story immensely. If I closed my eyes for a second or two it was because of the strong light from the fire.

✦ ✦ ✦

A. Do you begin to get my drift?

✦ ✦ ✦

Q. Frankly, Mr. Whoosis, no. You make the picture very clear, but I don't see the application.

✦ ✦ ✦

A. Be patient—I'm coming to the point. Here in America we have developed a feeble imitation of the English class system. We started out with a big middle class of small farmers, artisans and tradesmen. The industrial revolution hit us exactly as it did England, with the same results. It seems we now have what believes itself to be an upper class, composed of grandsons and great-grandsons of the big, tough, brainy, ruthless industrial pioneers. These poor little saps are rather pathetic. The English nobility shape up pretty well; after all, there is something in heredity, and old George W. Ancestor had what it takes, but deliver me from their American counterparts, poor bewildered incompetents who have a lot of money and only the faintest idea where it came from, except for a vague recollection of grandpa or great grandpa, a mean old crab who wore his boots outside his pants, chewed tobacco, and had to eat in the kitchen when company came.

✦ ✦ ✦

THESE tit-willies feel the competition pushing up from the middle class of industrialists, and fear and resent it. Their own incompetence is no secret from them and these manufacturers, traders, brokers, and what-not, are pretty keen-minded. Willie can't meet them on their own ground. But he knows F. D. R.; they went to the same dancing school, in their long yellow curls and lace pants. In politics when any upper class sap can get a start these days, he finds release for his inferiority complex. He can kick the manufacturers right in the face, just like the President. And so we find Mr. Roosevelt, surrounded by a fringe of little Vanderbilts, Astors, Whitneys, Harrimans, Biddles, and so on, palling up with the grimy sons of toil, kicking the manufacturer, the capitalist, whom they both hate. Both ends against the middle, just as in England. Now do you get the picture?

✦ ✦ ✦

Q. Yes, Mr. Whoosis, you make it very clear. That's the background of our parlor pinks. Do you figure they are steering us into communism?

✦ ✦ ✦

A. Well, yes and no. Not consciously, and not effectively, because these stumble-bums never do anything effectively. But it's just as well to watch them and check them from time to time, or first thing you know they'll have us in bed with Joe Stalin.

✦ ✦ ✦

Q. Don't you like our gallant Russian allies, Mr. Whoosis?

✦ ✦ ✦

A. Well now, sonny, that's a rather mean question. I don't like to seem unappreciative of what the Red Army is doing, but I do think we can look at the Red Army and communism as separate organisms. After all, the communist party is 2% of the Russian people, just as the New Dealers are 2% more or less, of the American people. If you think of the gallant Russian people as fighting for Communism, should you not consider that our boys are fighting for the New Deal? Are they? I figure the Russian people love their country and are fighting for it—not for communism, nor yet for democracy.

LET us say for the sake of argument that the Russian people do like Communism. Do you blame them, after what they've been through for the last thousand years? They have jumped out of the fire into the frying pan, and it's pleasanter there, no doubt. They know of nothing better. The mental strain of self government would probably drive them nuts. Good luck to them, say I. They're fighting for the same reason that we are, because somebody sneaked up behind and slugged them. Let's not argue about motives, but help each other as long as we are in a joint operation. After the victory we'll split a bottle of champagne, and go our ways, and thereafter our relations should be whatever an enlightened self-interest dictates.

✦ ✦ ✦

BUT just because we happen to be fighting the same apes, must we compliment them by adopting their form of government? Why can't they adopt ours? As a matter of fact they have moved a long way to the right of communism; they had to, to get anything done. I suspect they are slowly evolving toward capitalism, and toward self-government. We can watch them with sympathetic interest, but we'd better keep to windward. Capitalism and communism are both workable, if the people concerned are solidly behind them, but they don't mix. We're slightly infected right now.

✦ ✦ ✦

Q. What do you mean, infected, Mr. Whoosis?

✦ ✦ ✦

A. Well here it is. The chief tenet of self government is rotation in office. The theory is that the common man should leave his work and put in a spell legislating or administering, and then return to his work, thus never losing touch with his employers and with everyday affairs. The affairs of a republic are supposed to be so regulated that for every post of authority there are many capable citizens available. Now here, today, in a land of 130,000,000 people, it is widely believed that there is only one man capable of

holding the office of chief magistrate. We are slipping.

✦ ✦ ✦

Q. Then you feel, Mr. Whoosis, that it is domestic rather than foreign communists that threaten us?

✦ ✦ ✦

A. Precisely, We've got a bad set-up. There's Roosevelt and his tit-willies not so much communists as anti-capitalists. Backing them up are the godsakers, who as you know are the ex-almoners and social workers.

✦ ✦ ✦

THEY have derived their conceptions of capitalism from the hopeless wrecks to whom they have ministered all their lives. The philospher says a man may fail and fail, but he does not become a failure till he begins to blame others. The godsakers are thoroughly indoctrinated with the belief that capitalism is a brutal crime.

✦ ✦ ✦

THE tit-willies and the godsakers have another meeting ground beside their hatred of capitalism. They have both been brought up to spend money that they have not earned. Unlike the normal American, they have never worked to accumulate money and then figured out how they could get the greatest possible value for it; they first spend the money, and then consider who they can put the bite on. Their continuance in office, especially under these unusual conditions, makes our fiscal outlook decidedly grim.

✦ ✦ ✦

THEN there is a third group working against us, not impressive numerically but extremely influential. I mean the artistic group, in which I lump all those whose esthetic perceptions are unusually sharp, painters, actors, authors, musicians, teachers, and the like. Their emotions are easily stirred, their logical faculties are often somewhat atrophied from disuse; they are suckers for oratory on the plight of the common man. They have exceptional talents and exceptional opportunities for going to town on any theory that arouses their sympathies. And there's another thing about these people. They have good brains, better all-around minds, in many cases than industrialists whom society is rewarding more generously. In a capitalistic society competition for the consumer's dollar results in a rough-and-ready classification of values through which society rewards exceptional merit by granting it, through income, exceptional privilege and power. Many of these brainy folks are under-paid; what they have to offer is not exactly what the public wants, and these folks are apt to feel slightly embittered about it. It is, of course, a rather cruel and cold-blooded classification, but it is a thoroughly democratic process, a sort of election with dollars for ballots, and by and large it is fair, but a brilliant writer whose stuff is a bit too subtle for the multitude is apt to go sour on the whole set-up, and be willing to try a different set of rules.

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ADD up these three groups and they total to a tough problem. Sometimes I wonder whether we can get rid of them at any price short of a bad breakdown, for instance a real blitz inflation, a general strike, a real belly-gripping food shortage, any one of the disasters that the New Deal is trying to avoid by fast foot-work.

✦ ✦ ✦

Q. That opens up another matter, Mr. Whoosis, May I quote you on your reactions to rationing?

✦ ✦ ✦

A. What's the matter with you today, sonny? You keep pushing me into controversial subjects. Maybe this stuff I've been giving you is not hot enough for your taste.

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Q. Well, frankly, Mr. Whoosis, my editor thought we might count on something pretty daring, seeing the situation you are in, you know, after all, what have you got to lose? Don't blame me now, Mr. Whoosis, you know what editors are.

A. Yes, to be sure I'm here in the pen, but have you forgotten that there is such a thing as time off for good behavior? I haven't. And anyway there's no rationing problem in my life. I'm in a government institution, and food is plentiful, such as it is. I did find a horse-shoe in the corned beef hash yesterday, but the chef claimed he and the scullion had been pitching quoits, so that blew over.

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Q. Aw, come on, Mr. Whoosis, give me something hot on the food shortage.

✦ ✦ ✦

A. The hottest thing I can offer is to quote Thomas Jefferson's remark, to which I have called your attention before. "If we depended on Government to tell us when to plant and when to reap, we should soon want bread." Well, we did and now we do.

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Q. Is that the best you can do for me?

✦ ✦ ✦

A. Well, sonny, if you want to stir up some fun, get your Senator to rise up and ask a question. Here's the set-up. We are giving up 57% of our canned goods. Our forces overseas are about 3% of our population. Let's say they get 10% of the food. Lend-lease Stettinius says he is using less than the armed forces. Let's say that totals 17%. **Where is the other 40%?**

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Q. Give me something on the labor situation, Mr. Whoosis.

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A. You little rascal, you know how to get me hot, don't you? That's an opening I never can resist. I'll sum up the labor situation for you in two words. It stinks.

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Q. You said that last year.

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A. Well then, give me three words. It stinks worse. In fact it is so bad now that various neutrals who have never had real contact with it have begun to lift up their heads and sniff. And a hell of a lot of boys over in Africa are sniffing, and snorting, and

(*Please turn to Page 247*)

Developments in the Small Diamond Die Industry

A summary of the last meeting of the Small Diamond Die Industry Advisory Committee held February 18th, 1943 at Washington, D. C.

A COMMITTEE representing the Industry, Government and others was organized some time ago to discuss the problems which had developed in connection with the production of small diamond dies needed for the war effort.

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ON February 18th, 1943, the committee met to consider (1) requirements and production for 1943, (2) results of tests on dies, (3) increasing the productivity of dies, (4) increasing the quantity of dies, (5) manpower problems.

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Requirements and Production For 1943

IN October 1942, production of small-diamond dies for 1943 was set at 24,000. In October the industry was producing at the rate of 13,000 dies a year, which has been increased to a current rate of 17,000. Because of manpower-saving methods which the being introduced into the industry this year, the MSMN Division hopes to raise 1943 production to a minimum of 27,000 dies. If workers were required to work nights, it would be possible to force the total to 30,000.

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WITH a probable total of 27,000 dies for 1943, small-wire manufacturers will have to turn out 100,000 pounds of wire for the year, the requirement recently determined. Of the 100,000 pounds of wire, 78,000 pounds are to be of .0015 size and smaller.

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THE important question is whether industry is satisfied that 27,000 dies will be enough to manufacture the 100,000 pounds of wire required for 1943. One of the committee members pointed out that 9,000 dies were required in 1942 to produce 30,000 pounds of wire, 22,000 pounds of which was of .0015 size and smaller. This means that, allowing for various safety factors, 45,000 dies would be required for 1943; or without the safety factors, 32,000 dies. One of the wire manufacturers stated that domestic dies did not average 4 pounds of wire and often produced only 2½ to 3 pounds. Another wire manufacturer said that for December 1942 his company had maintained an average of 5 pounds of wire for the .0015 size. Exact information about production per die is meager. It is clear, however, that the Division must consider the possibility of setting higher production quotas. It is believed that in view of changes contemplated in production methods, 27,000 dies for 1943 should be a sufficient number.

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Examination of Dies

IN order to permit inspection of dies, there are two possibilities that may be followed: (1) Dies may be delivered unmounted to wire manufacturers; or (2) dies must have a window in the casings so that they may be examined. Committee members did not believe that delivery of unmounted dies would be satisfactory. One of the die manufacturers said that it would be difficult to reset dies properly if they were taken out for inspection. It was suggested that the only practicable way for inspection might be to put a window in the casing of the die. It was stated that a company able to polish windows, in quantity, on the diamonds now exists.

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RESULTS of Tests.—Results of tests on dies set in casings through which holes had been drilled, show as follows: Die No. 1 was difficult to start and drew only 2 ounces of wire. Die No. 5 drew 4 pounds, 6 ounces. Die No. 3 drew 4 pounds, 2 ounces. Die No. 4, which had the elements that a good die is supposed to have, drew 7 pounds, 6 ounces. Die No. 2 has just gone into the machine. Die No. 6 will be put into the machine when tests on Die No. 2 are completed. The dies were set up to be used on one machine on a single pile of wire from one coil and one heat. All of the dies had a narrow cone.

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MAGNIFICATION.—In answer to a question about what degree of magnification is necessary to see a profile sufficiently enlarged, one of the committee members said that 75 is desirable, but that much can be done at 40.

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REQUEST for Report on Tests.—One of the die makers requested that wire manufacturers give them a complete report on dies submitted for tests. Such a report will enable the die maker to turn out a better product, it was explained.

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Increasing Productivity of the Die

GOVERNMENT Research Laboratory.—A Government research laboratory is now being organized to which members of the

(*Please turn to Page 238*)

✦ GOVERNMENT WIRE PRODUCTION INFORMATION ✦

Simplified Practice Recommendation for Wire Rope, Approved By Industry

A SIMPLIFIED Practice Recommendation for Wire Rope has been approved for promulgation, according to an announcement by the Division of Simplified Practice National Bureau of Standards. It became effective February 15, 1943, and will be identified as "R198-43."

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THE program, which lists sizes, constructions, grades and breaking strengths of the vast majority of tonnage of wire rope, was developed by engineers of the wire rope industry, to serve as a wartime conservation measure and as a guide for post-war practice.

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IT is concerned primarily with items that are produced for stock purposes, and does not attempt to deal individually with the numerous and particular end uses to which wire ropes are put. These special purpose ropes will be furnished by the manufacturers, only when their necessity has been demonstrated. The producers of wire rope will view this necessity in the light of the war production program.

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THIS simplification program, the result of long study by the industry, was passed through the regular procedure of the National Bureau of Standards at the request of the War Production Board. General adherence to the recommendation will result in a net reduction in variety from 973 items to 643, or 33.9 percent. The major production and use of wire rope and, therefore, the predominant tonnage, is covered by four different rope-constructions, where the reduction in variety will be from 352 items to 182, or 48 percent.

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PENDING printing of R198-43, information concerning this recommendation may be obtained upon request from the Division of Simplified Practice, National Bureau of Standards, Washington, D. C.

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Brass and Wire Mill Products

IN order to avoid confusion, Copper Order M-9-a has been amended to place the control of warehouse sales of brass and wire mill products entirely under CMP Regulation No. 4.

✦ ✦ ✦

UNDER this Regulation, warehouses distributing brass and

(*Please turn to Page 232*)

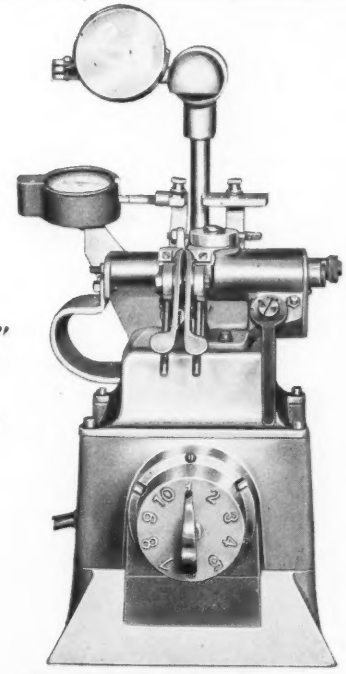
MICROMETER PRECISION MICRO-WELD TRADE MARK REG. U. S. PAT. OFF.

CONTINUOUS IMPROVEMENT

MICRO-WELDERS with dial indicating annealing attachments are now available for high carbon wire.

There is positive control of annealing temperature and already hundreds of these special MICRO-WELDERS are proving their dependability and satisfactory performance with leading manufacturers.

Model E.-I-S Welder Capacity .010 to .062" high & low carbon wire.



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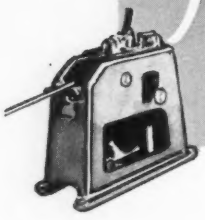

Uniformity

OF QUALITY AND FINISH

Uniformity of quality and finish must always remain the primary objective of the wire manufacturers.

STANDARD WIRE DRAWING COMPOUNDS have the properties to fulfill demands for increased speed, longer die-life, and the highest quality of wire. One of our technical men will demonstrate the merits of our products to prove our claims.

A FEW OF OUR REPRESENTATIVE LUBRICANTS ARE LISTED BELOW

#90

For low and high carbon wire drawing on rod machines or bench. Finish suitable for rope, nails, bale tie and common wire.

#50

For high carbon spring wire. Leaves ideal coating for spring coiling machines. For both machine and bench drawing.

#33

For one or two hole extra bright market wire, welding wire and stainless steel.

#18

For wet wire drawing of copper, brass, low or high carbon steel galvanized wire.

STANDARD INDUSTRIAL COMPOUNDS COMPANY

4600 FERDINAND STREET SIC CHICAGO • ILLINOIS

Government Wire Production Information

(*Continued from Page 231*)

wire mill items have been permitted since February 15 to fill authorized controlled materials orders, or orders bearing preference ratings of AA-5 or higher for 500 pounds or less of any item to any one destination at any one time. No more than 2,000 pounds of any one item may be delivered to a customer during a calendar month. All orders must be accompanied by a prescribed certificate, signed by the person placing them.

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PREVIOUSLY, Order M-9-a permitted the delivery of brass and wire mill products only on orders bearing AA-5 or higher ratings. Prior to issuance of CMP Regulation No. 4, no quantity restrictions were placed on deliveries by warehouses.

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Wire and Cable Company Reports

WIRE and cable companies are urged by the Copper Division, War Production Board, to submit their reports by the fifth of the month, as instructed.

✦ ✦ ✦

A NUMBER of companies have not submitted their reports by the required date, in previous months and thereby have caused a delay in the processing of the reports for allocation. Hereafter, the Division said, reports will be processed and allocations will be made shortly after the fifth of the month. Reports received later will not be processed until the completion of all those received on time.

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THERE is a distinct possibility, it was pointed out, that at this later date, the amount of material available for allocation will be insufficient to take care of the delayed reports.

Output of Heavier Gauge Barbed Wire for Farm Use Permitted By WPB Ruling

PRODUCTION of heavier gauge barbed wire and an additional style of wire fence needed to meet the farm production goals of the Department of Agriculture will be permitted under Schedule 3 of Limitation Order L-211, as amended by the W.P.B.

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UNDER the new specifications, 2 point barbed wire can be made in two styles, while 4 point wire can be made in one style. Previously, manufacture of only one style of 2 point wire was permitted.

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THE revised schedule also provides for the production of an additional style of hog and cattle fence requested by the Department of Agriculture. Other changes:

1. **Make it clear that wire netting and flooring not designed for farm use are nevertheless covered by the established specifications.**
2. **Restrict galvanizing of wire by limiting use of zinc coating to the weights established by Federal Specifications, as outlined in the Schedule. Producers are urged to use lead instead of zinc coatings wherever possible.**

✦ ✦ ✦

Bedspring Production Order Amended

CALCULATION of the base period use of iron and steel in the production of bedsprings is specifically clarified in Limitation Order No. L-49 (Beds, Springs and Mattresses) as amended by the Director General for Operations. The amended form also exempts manufacturers of bedspring parts from the provisions of the order because production of complete bedsprings is controlled.

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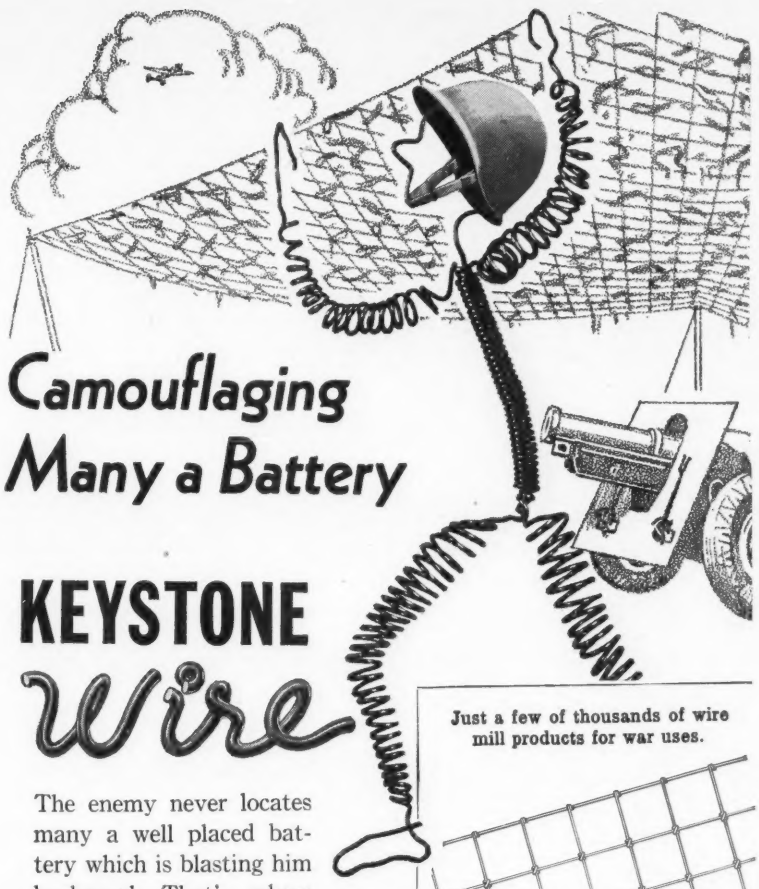
TOTAL use of iron and steel during the base period (the year ending June 30, 1941) includes only the steel used in coil, flat, and fabric bedsprings which were not integral parts of beds or other sleeping equipment and all the steel used in box bedsprings. Prior to the new amendment, all

(*Please turn to Page 234*)



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Just a few of thousands of wire mill products for war uses.

Special Analysis Wire for All Industrial Uses

SAMSON SPRING WIRE

Government Wire Production Information

(*Continued from Page 233*)

four types of bedsprings, whether integral parts of beds or other equipment, or separate units, were included by some manufacturers in their base period totals. In such cases, cots, day beds, berths, etc., were included in full weight for the total base period use and requested quotas were delayed for proper revision. In the order as revised, this is specifically not permitted.

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PERCENTAGES of permitted production and weight limitations per unit remain unchanged. During the two months beginning February 1, the manufacturer is permitted to use in his production of coil, flat, box, and fabric bedsprings up to 2½ per cent of the iron and steel used during the base period for the production of coil, flat, and fabric bedsprings, plus 4 1/6 per cent of the iron and steel used in production of box bedsprings during the same period. Since this covers only a two-month period, the percentages are proportionately equal to the previous percentages for the full quarter. During subsequent quarters those percentages will be resumed on the full quarterly basis.

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Class A Products

MANUFACTURERS of items identified as Class A products under the Controlled Materials Plan may now apply for their allotments of aluminum, copper, and steel on one of the simplest Government forms ever devised, War Production Board officials have announced.

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FORM CMP-4A, formerly a four-page sheet, has been revised to provide a single, letter-size page, on the reverse of which are printed instructions for filling out the streamlined application. What a manufacturer makes, how much controlled material he needs, and when he wants it delivered is all the information required of him. When the answers to the two latter questions have been determined, the actual filling out of the new CMP-4A will take only a matter of minutes.

✦ ✦ ✦

THIS revised form, which was recently mailed to industry for use in connection with materials to be delivered during and after the third calendar quarter of this year, is in line with WPB's announced policy of simplifying CMP procedure wherever possible without endangering the orderly flow of vital materials.

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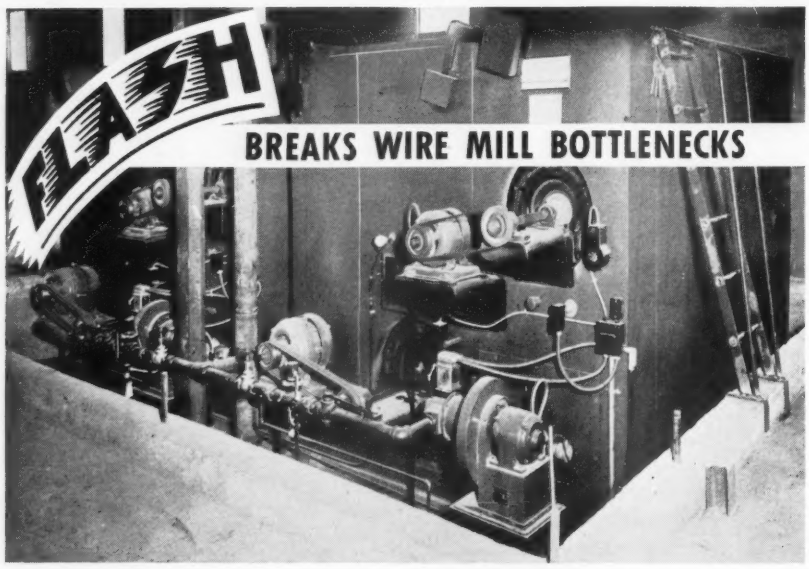
Brass and Wire Mill Products

IN order to enable warehouses distributing brass and wire mill products to make certain sales in commercial units weighing more than 500 pounds. Brass Mill and Wire Mill Direction No. 1 under Controlled Materials Plan Regulation No. 4 was issued by the Director General for Operations.



Morrison Engineering in the form of the original FLASH BAKER removed a bottleneck from wire manufacturing years before the war made necessary added speed and production.

Two years ago the indirect-fired type was redesigned to incorporate last minute refinements.

Today a standardized design that shrinks hours to minutes is available for use with any type of fuel—embodying every feature dictated by a broad experience in heating and a knowledge of everything that is required to do a good baking job on any wire mill product.

Literature sent on request.

Check these Advantages of

MORRISON ENGINEERED FLASH BAKERS

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FORMERLY, CMP Regulation No. 4 limited deliveries of copper products from warehouses to not more than 500 pounds of any item to any one destination, at any one time. Under the Direction issued, this limitation will no longer apply to deliveries of wire and cable, sizes 4/0 and larger, in full reels not exceeding 1000 feet each, or to any of the following items: Condensor tubes; a single straight length of rod, tube, pipe, sheet or strip; welding rod, delivered prior to April 1, 1943.

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ORDERS for any of the foregoing must be accompanied by, or endorsed with, the appropriate form of certification, and the 2,000 pound quarterly limitation provided in CMP Regulation No. 4 will continue to apply deliveries.

✦ ✦ ✦

THE new Direction also provides that warehouses, in specific instances, may apply to the War Production Board for authority to make, and for the purchaser to accept, deliveries of other brass and wire mill products in quantities exceeding those listed in CMP Regulation No. 4.

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Steel Division of WPB Organizes Aircraft Section

AN Aircraft Alloy Steel Section has been set up in the Steel Division to help speed deliveries of certain alloy items to aircraft plants. The new Section is headed by **Louis E. Creighton,** formerly Vice President of the Rotary Electric Steel Company of Detroit, and for many years an operating executive of the Union Drawn Steel Company.

✦ ✦ ✦

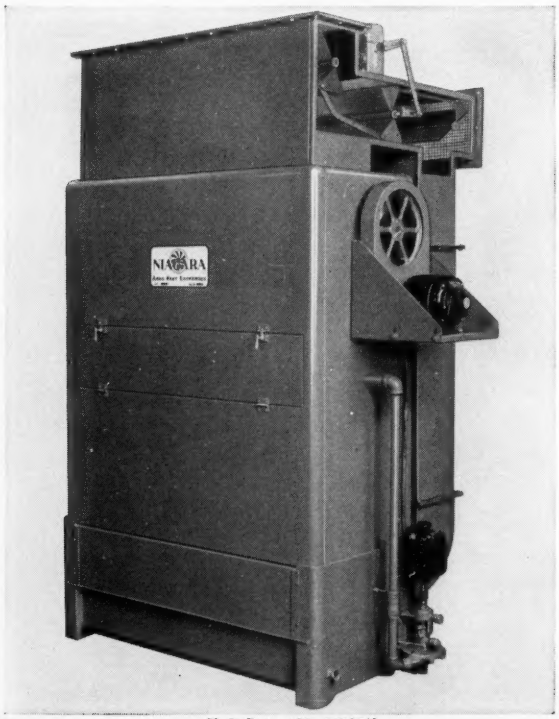
PRODUCTION of alloy steel ingots for aircraft and the many other wartime uses rose in January to 1,260,000 net tons — more than 300,000 tons above the 1942 average monthly output. In 1938, alloy steel production averaged only 138,000 tons monthly. By 1944, the nation's capacity for producing alloy steel will be about 1,400,000 tons a month.

B-G-R Detroit Springmakers Win "E" Flag

OUTSTANDING work in speeding up spring production has won the Army-Navy Award for the Detroit Plant of Barnes-Gibson-Raymond Division of Associated Spring Corporation.

✦ ✦ ✦

THE Flag was presented to the men and women of this plant on Feb. 8, in the General Motors Auditorium. Lt. Col. Hugh J. McNally of the Air Corps presented the flag to William M. Barr, acting general manager of Barnes-Gibson-Raymond Division. John Tullis received the pins for B-G-R employees from Lt. Comdr. Arthure Langfield, U.S.N. (Ret.). This is the second division of the Assoc. Spring Corp. to receive the "E" Flag—the Wallace Barnes Co. Div. having received theirs last October. B-G-R men and women now possess the two highest honors in industry, the "E" Flag and the "Bull's-eye" Treasury Flag for purchase of war bonds.



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NIAGARA AERO HEAT EXCHANGER provides an improved, patented method of applying the evaporative cooling principle; it saves 95% of cooling water, it gives accurate temperature control; it saves cost of both shell-and-tube cooler and cooling tower; it saves costly and hard-to-obtain piping and pumps; it saves the cost of pumping large quantities of water; it saves the maintenance troubles and costs of piping systems.

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Testing in the Metal Industry

(*Continued from Page 224*)

in specifications or in texts presenting and discussing the particular methods of testing. Methods which require or reveal very small amounts are known as micro-methods.

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I. Non-Destructive Methods of Control

SUCH testing methods are those in which it is not necessary to cut up the material to obtain a sample for further testing. Visual examination is often sufficient to judge the quality of a product, trueness to size, lack of surface blemish or defect, proper stiffness, the right color, and absence of peeling of protective coating. Other types of visual examination require some equipment, the test usually being simple, the apparatus more or less complicated. An example would be the method to detect the susceptibility of 18:8 steels to intergranular corrosion by using a small electrolytic cell and polarized light. Manufactured products of light metals may be examined radiographically through a fluoroscopic screen and their metallic soundness judged. Thickness of sheets, roundness of wire, and many other measurements can be easily made. The thickness of non-magnetic coatings can be tested with a magnetic tester, scleroscope hardness measurements are made on finished parts and roller bearing balls bounced on a hard surface, temperature measurements with a pyrometer, sparks tests on metals, chemical spot test, fluorescent lighting to separate special type of steel scrap, stroboscopic examination of parts subjected to stresses while in motion, and strains measured with brittle lacquers. These are some of the various types of non-destructive testing methods of a visual nature.

✦ ✦ ✦

OTHER tests make use of such properties as the transmission of sound through the material to detect flaws, or to check the ring of the metal. Ultra-sonic waves are also being used to detect flaws in finished metal parts.

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VARIOUS magnetic tests are available for non-destructive testing depending on the shape of the material. The most popular is the magnetic[1] powder method, which has been modified to show up fluorescence on holding against a dark back ground, or in ultra-violet light[2]. This change makes possible easier examination of surface flaws as well as flaws close below the surface. A new fluorescent method[3] has been developed to examine for flaws non-magnetic materials.

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NON-DESTRUCTIVE tests may be of the recording type, a most interesting example being the control of chemical analysis of a bessemer heat of steel by means of a photoelectric cell.

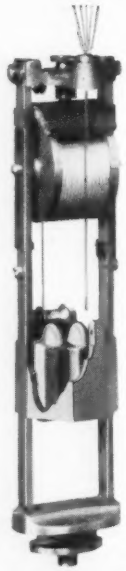
✦ ✦ ✦

THE recording of non-destructive physical testing methods is usually done on photographic materials. To measure deflection

[1]All references published at end of article.

"TRITON" HIGH CAPACITY WIRE CARRIERS

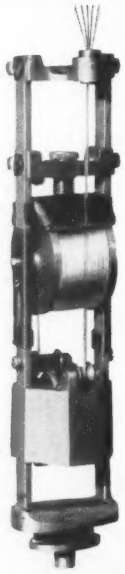
For Precision Hard Wire Braiding, Hydraulic Flexible Tubing, Hose and Electric Cables



"Triton" carriers are patented in all principal countries.

Patented swivel top used on larger sizes.

Braided flexible tubing made with "Triton" carriers.



Note the loose weights supplied in the tension box.

The latest development in wire braiding is our new carrier. Can be used on most braiding machines. New principles increase output without change in running speeds. Perfect control makes for precision braiding at all speeds. Accurately and sturdily made.

Let us quote prices. Send us your horngear size depth and profile of track and number of gears and carriers. Catalog No. 10/4 will give description and specifications of all Carter carriers. We shall be glad to send you a copy.

SOLE MANUFACTURERS

B. & F. Carter & Co., Ltd., Bolton, England

ALBION WORKS • WATERLOO STREET

MACHINERY FOR BRAIDING, TUBING, INSULATING CABLES, ETC.

on members in actual service stroboscopic light may be used. To test for soundness of castings, welded structures, for techniques of production and to improve upon them use is made of radiography, either with X-rays or with gamma rays. This last is simpler insofar that no complicated apparatus is necessary. A photographic film of suitable size is placed behind the object to be examined in both cases, the object being placed at a certain distance from the source of rays. With radium a great number of objects may be photographed at one time. The number to be examined with X-rays is restricted to one, except if a million volt[4] machine is used. The advantages and disadvantages of these two methods of testing have been discussed extensively in recent scientific and technical literature.

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IN summary, Table I gives a list of the various methods of non-destructive testing available, giving briefly their name, property made use of and some applications.

II. Destructive Methods of Testing

THESE methods of testing are numerous, many of them time honored. In some cases a sample may be used as received, in many the sample has to be prepared to comply with specifications, particularly as it refers to size, and to obtain results which can be matched or compared with results obtained with similar type samples of the same or other materials.

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IN Table II are summarized several of the common methods of testing and some of the newer without attempting to make the list complete.

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IN actual service metals are not subject to only one type of condition. For example, the endurance of many materials is severely reduced when the surrounding medium is corrosive. To test for this corrosion fatigue tests are devised.

✦ ✦ ✦

TESTS are used in metallurgical laboratories to determine the quality of metals and their alloys for wear, machinability, and deep drawing. These properties of materials are rather complex, and no fool-proof methods of testing have been found. A combination of the simpler tests already outlined have been correlated to actual working results.

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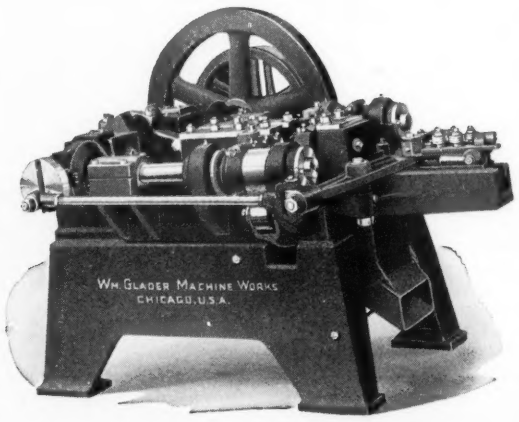
IN this paper have been noted some of the apparatus and techniques developed by the scientist which have been applied variously to control and to testing. Recent applications worth calling attention to are microradiography, the electron microscope, electron diffraction, and the use of the cathode ray oscillograph in the determination of rapid cooling rates of quenched steels.

✦ ✦ ✦

IN conclusion, the men in the metallurgical laboratory are on the lookout for techniques and apparatus which will make possible automatic and recording control of industrial operations. They are also

(*Please turn to Page 238*)

HIGH SPEED WIRE NAIL MACHINE



WM. GLADER MACHINE WORKS

210 N. Racine Ave. Chicago, Illinois

Glader Machines on large head, single-blow roofing nails can be seen in operation at any of the independent wire mills in the United States.

The production figures on common nails shown below, are guaranteed.

SIZE MACH.	SIZE WIRE	MAX. LENGTH OF WIRE	NUMBER OF NAILS PER MIN.	CAP. IN POUNDS PER HR.
#00A	#16	1⅛"	700	37.2
#00	#14	1¼"	550	55
#0	#12	1¾"	450	89
#1	#10	2½"	400	192
#2	#8	3½"	325	310
#3	#4	5"	225	523
#4	#1	7"	190	622
#4s	5/16"	9"	175	1155
#5	⅜"	12"	160	2400

This high output and economical operation account for the GLADER machine being accepted as standard equipment in all recent installations.

Testing in the Metal Industry

(*Continued from Page 237*)

interested in testing methods which reduce the time necessary to carry out tests or make possible obtaining more accurate information which can be used to make a product of quality. Mathematics, in the form of statistics, is also playing a more important role every day for a better understanding of production and quality.

1. **Magnaflux**
2. **Magnaglow**
2. **Zuglo**
4. **G. E.**

Developments in the Small Diamond Die Industry

(*Continued from Page 230*)

industry are sending machinery. Dr. Peters and Dr. Insley of the Bureau of Standards will aid in experiments to determine the best contour and shape for a die and to improve the quality of the polish. Most manufacturers are already making dies of the contour and shape thought to be best. Improvement in the quality of finish is expected to be an important part of the laboratory's work.

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DR. PETERS indicated that the laboratory will experiment on both shape and finish of dies and it is hoped that specifications will be arrived at for a die of maximum life. The cooperation of die and wire manufacturers is needed in the project. It was pointed out that the Bureau of Standards has all the equipment necessary for the investigation, other than that incidental to the manufacture of dies and the drawing of wire.

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BRITISH Experience. — The research laboratory has been patterned with regard to experience in the British laboratory. The British are stressing polish and have even built polishing shops separate from drilling shops. Industry in the U. S. is producing a better die than it did 4 months ago, and if the quality of finish could be improved, the life of dies might be increased to such an extent that 27,000 dies would be the equivalent of 40,000.

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Increasing Quantity of Dies

A NEW method of producing small diamond dies by machine has recently been developed by one of the companies in the industry. A working unit is made up of six drilling machines and one coning machine and after about three months training each unit employing seven or eight people two or three workers on a shift for three shifts a day should be able to make about 200 dies a month. Five units are being manufactured at present and it is expected that additional units will be placed in production as rapidly as they are manufactured. It was estimated that 4,000 dies can be produced by these machines this year.

✦ ✦ ✦

USE of Lucite. — It was suggested that lucite be tested for dies used for cold-drawn wire. Those who drill in nibs are to investigate the type of solder to be used there.

AT AUCTION

REAL ESTATE, MACHINERY and EQUIPMENT

of

HARRIS WIRE WORKS PLANT

of

SPENCER WIRE CO.

at

SPENCER, MASS.

On the premises

THURSDAY, APRIL 22, 1943 at 11:00 A. M.

The Real Estate consists of about 65,000 Square Feet of Floor Space in Three Mills. Valuable Water Power and Rights.

The Machinery and Equipment includes:

Wire Machines: 1 20 block rod frame complete with motor and drive
1 5 block rod frame with drive
1 24 block 15 frame complete with motor and drive
1 16 block 15 frame complete with motor and drive
1 20 block 15 frame complete with motor and drive
45, 10-16-20 block wire finishing frames
4, 8″ wet continuous machines
2700 Wire Drawing Dies, assorted sizes;
4 Two Compartment Wire Galvanizing Units; Annealing Furnaces.

Cranes: **Northern 7½ Ton Electric Traveling Crane**, 28 Foot Span, 80 Foot Runway.

Scales: **Howe Automatic Weightograph Floor Scale,**
3 Howe Automatic Dial Platform Scales, Model 1400.

Motors and Transformers: **10 General Electric Motors, 10 to 100 H.P.;**
20 General Electric, Pittsburgh and Allis Chalmers Transformers, 7½ to 100 K.V.A.; Starters, etc.
7 Wheelco Electric Temperature Controls, Model 221.

Machine Tools: Garvin #4 Plain Miller; Whitcomb Single Head Planer, 24″ x 24″ x 72″; Morse Single Head Planer; Ames Back Geared Engine Lathe, 18″ x 22′; Craftsman Portable Electric Arc Welder, Model 113; Speed Lathes, Power Hack Saw; Prentice 20″ Drill Press; Shepard Back Geared Engine Lathe, 20″ x 8′; Rivett #103 Grinder.

Factory Equipment: **Steel Floor Plates,** Pulleys, **800 Feet Page Galvanized Wire Fencing,** 72″ High; Worthington Deep Well Pump, **Bolinders 175 H.P. Diesel Engine;** Stewart Horizontal Steam Boiler; Steel Smoke Stacks; Narrow Gauge Tracking, Rodney Hunt Water Wheel, Forges, Chain Hoists, Wire Trucks, Wire Baling Press, etc.

Sale by order of Spencer Wire Co., Owners.

SAMUEL T. FREEMAN & CO., Auctioneers

Established
Nov. 12, 1805

80 FEDERAL STREET **BOSTON, MASS.**

Sale subject to all O.P.A. and W.P.B. Rulings.

Manpower Problems

SINCE it is increasingly difficult to get deferments of workers. It was suggested that all companies start a training program, so that new workers may be trained to replace men inducted into the Army. Industry was advised not to seek to obtain deferments indiscriminately, but to make sure that the person for whom the deferment is sought is a key man. Training schools are to be established in Fort Wayne and in New Jersey.

✦ ✦ ✦

Next Meeting

THE next meeting was set for March 18th but was cancelled because the Government research laboratory which is being organized by the Bureau of Standards is now taking pictures and making detailed examinations of various types of small dies, and they will not be able to report to the Committee for several weeks. The next meeting is scheduled for April 15th in Washington, D. C., and a report of its proceedings will be published in WIRE & WIRE PRODUCTS.

✦ ✦ ✦

New Electric Wire for Wartime Building

A NEW way to save rubber and tin was revealed when the National Electric Products Corporation of Pittsburgh announced a revolutionary new type of electric wire for wartime building with all critical materials deleted from the covering, leaving only the copper conductor itself of a vital nature. Prior to this development, most building wire had for many years been coated with tin and wrapped in rubber and a considerable volume of these materials was used every year in wire production.

✦ ✦ ✦

I. A. BENNETT, vice-president of the National Electric Products Corp., states research was started shortly after Pearl Harbor, to find a non-critical wire covering which would conform to the stringent requirements of fire and moisture resistance necessary for building wiring. A new insulating material together with a specially treated paper was developed which seemed to do the job as well as any tin and rubber combination, and after exhaustive tests, the resultant rubber-less wire is now ready for general distribution.

✦ ✦ ✦

Revised Booklet on Wire Tester

MANUFACTURERS of wire, motor windings, electrical instruments and meters, and electrical household appliances, as well as many laboratories, repair shops and maintenance departments, where routine resistance tests are made, will be interested in a newly-revised, illustrated catalog describing the L&N Type S Test Set. It is a general-purpose Wheatstone bridge with self-contained galvanometer and battery.

✦ ✦ ✦

A COPY of this 8-page publication will be sent to anyone interested. Address the **Leeds & Northrup Company**, 4934 Stenton Avenue, Philadelphia, Pa., and ask for Catalog E-53-400(1), "Type S Test Set."

NEW HORIZONS

THAT ADVERTISING WILL HELP TO ACHIEVE

As we drive forward toward Victory it is time to start planning for post-war business. The challenge is before every one now making the tools of war. The kind of future we will enjoy is squarely upon our industrial leaders, large and small—upon the management of every business enterprise.

Those who advertise tell the world of their faith and hope—and the expression of confidence contributes to the end desired—free enterprise, opportunity for initiative, and the utilization of new products, processes and machinery. These are the men whose prestige is kept solid, whose basis for the future is firm.

Your advertising can be helpful, informative, useful. You may have to struggle with priorities, allocations, reports and war-imposed regulations for some time, but looking ahead, starting to prepare now, will help you and your customers to attain the visions now on the horizon to which we all aspire.

Advertise to reach the WIRE INDUSTRY in

WIRE & WIRE PRODUCTS

300 Main Street **Stamford, Conn.**

Official Publication of the Wire Association

Outstanding Personalities of the Wire Industry

Wickwire Spencer Steel Appoints W. C. Shattuck Wire Sales Manager

WICKWIRE Spencer Steel Company, 500 Fifth Avenue, New York City, today announced the appointment of **Wilfred C. Shattuck** as Wire Sales Manager. Mr. Shattuck will be located in the company's New York offices.

✦ ✦ ✦

MR. SHATTUCK was graduated in 1924 from Brown University with the degree of Ph. B. After a year's law study at Columbia University, he joined the sales staff of Wickwire Spencer, with whom he remained in various sales capacities until 1940.

✦ ✦ ✦

HE returns to Wickwire after two years with John A. Roebling's Sons Company, first in their New York office and later as Manager of Sales, round wire, flat wire and specialties division, Trenton, N. J.

W. C. SHATTUCK
who has been appointed Wire Sales Manager of Wickwire Spencer Steel Company

John E. Fredrick

JOHN E. FREDRICK, age 77, Chairman of the Board of Directors, Director and member of the Executive Committee of the Continental Steel Corporation, Kokomo, Indiana, died Wednesday, March 3, 1943, at Indianapolis, Indiana, after a brief illness. Funeral services were held in Kokomo, Friday, March 5.

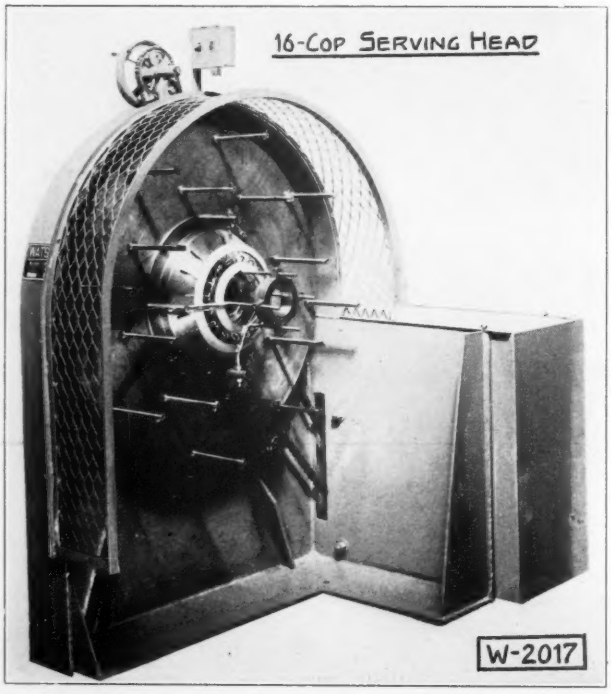
✦ ✦ ✦

MR. FREDRICK was one of the founders of the Kokomo Fence Machine Company in 1896. He, with two associates, perfected and sold a small portable hand machine to be used by farmers in the weaving of wire fencing to replace the old zigzag rail fences which were used at that time.

✦ ✦ ✦

IN 1901, Mr. Fredrick was one of the organizers and was

THE WATSON MACHINE COMPANY
PATERSON, NEW JERSEY, U.S.A.
ELECTRICAL WIRE AND CABLE AND WIRE ROPE MACHINERY



SERVING HEADS

16-COP UNIT SHOWN HERE PROVIDES FOR:—

2½ LB. COPS
(4¼" x 6" x 9/16")

240 Head R.P.M.

Reversible Reeves Drive

3" DIA. PASSAGE

AUTOMATIC STOP

SIGNAL LIGHT

chosen General Manager of the Kokomo Steel and Wire Company which was incorporated that year and which was essentially a rod and fence mill. Later, Open Hearth furnaces were added.

✦ ✦ ✦

IN 1927, the Continental Steel Corporation was formed which included the Kokomo Steel and Wire Company, also The Superior Sheet Steel Company, Canton, Ohio, and Chapman Price Steel Company, Indianapolis, Indiana. Mr. Fredrick, at that time, became Chairman of the Board, Director and member of the Executive Committee of Continental Steel Corporation.

✦ ✦ ✦

IN 1908, Mr. Fredrick was one of the organizers and was the first President of the Indiana Manufacturers and Shippers Association. As one of the organizers of the Indiana Chamber of Commerce, he became its first President in 1921 and served as such for more than twenty years.

✦ ✦ ✦

IN 1929, he was appointed a member of the State Tax Commission to study the Indiana Tax System. He served as President of the Kokomo Chamber of Commerce for many years, as a member of the City School Board and the City Board of Safety. He was Chairman of the Board of Directors of the Union Bank and Trust Company and American Art Alloys Company and Director of the First Federal Savings and Loan Association, all of Kokomo, Indiana, and a member of Rotary, International.

✦ ✦ ✦

Charles Arthur Davis

CHARLES ARTHUR DAVIS, 55, assistant general superintendent of the Youngstown district plants of the Youngstown Sheet & Tube Company, died recently following a short illness.

✦ ✦ ✦

MR. DAVIS came to the Sheet & Tube organization 35 years ago, from Chicago. He started as a roller on one of the old hand sheet mills of the company. Eight years later he was appointed on the committee which recommended to the Sheet & Tube company the plan of employe representation later adopted by Sheet & Tube and subsequently by all of the major iron and steel companies of this country. In 1919 he was chosen chairman of the group.

✦ ✦ ✦

IN 1920 he was advanced to superintendent of the sheet mills, and shortly thereafter became superintendent of this division. In March, 1929, he was appointed assistant general superintendent of the plants in the Youngstown area, a position which he held at the time of his death.

If You Are Not A Member Of
The Wire Association —
Now Is A Good Time To Join!
The Annual Dues Are $10.00

HERE'S A TONIC FOR WEARY WIRE MACHINES . . .

Give your wire machines a new lease on life by equipping them with TECO Carbide Dies. The high-speed, long-run capacity of TECO Carbide Dies produces greater tonnage per machine — tonnage of the highest degree of accuracy, smooth finish and physical properties. This superior performance is due to the rigid standards of uniformity, density and hardness to which TECO Carbides are held through every step in manufacture.

A test run with TECO Carbide Dies in your mill affords the soundest proof of these facts. Let our engineers know your requirements now.

WIRE & BAR DIES
EXTRUDING DIES
TUBING DIES
SIZING DIES

Also Carbide Blanks, Tools, Bits, Reamers and Forming Tools.

TUNGSTEN ELECTRIC CORPORATION
564 39th STREET, UNION CITY, N. J.
Branch Office: 2906 Euclid Ave., Cleveland, Ohio
Representative: Architects & Builders Bldg., Indianapolis, Ind.

TECO
Pioneers in Tungsten Carbides for over a Quarter Century
CARBIDE DIES

A Review of Recent Wire Patents

No. 2,309,745, METHOD OF PROCESSING WIRE, patented February 2, 1943 by Thomas G. Bergin, New Haven, Conn., assignor to The American Steel and Wire Company of New Jersey, a corporation of New Jersey.

After the wire is freed of heavy oxide or scale, it is passed, while out of contact with oxidizing agents, to a low-temperature molten salt bath containing a cyanide, where it is thoroughly deoxidized and a temporary coating of salt adheres to the wire to protect it.

✦ ✦ ✦

No. 2,309,880, SPRING CONSTRUCTION, patented February 2, 1943 by Robert Frank Winders and Arthur Laurenz Winders, South Gate, Calif.

Paralleling, helical coil springs are joined by zig-zag strips, which are also connected to resilient strips bridging the spring assembly frame.

✦ ✦ ✦

No. 2,309,992, ELECTRIC POWER CABLE, patented February 2, 1943 by Thomas Robertson Scott and John Krauss Webb, London, England, assignors to International Standard Electric Corporation, New York, N. Y.

Invention lies in the provision of insulating material comprising lappings of fibrous material impregnated with polymerized material interleaved with lappings of fibrous material impregnated with cable compound, the whole being permeated by cable compound.

Complete Descriptions and Drawings of Patents May Be Had for 25 cents. Address, Wire & Wire Products, 300 Main St., Stamford, Conn.

No. 2,310,914, APPARATUS FOR OPERATING ON WIRE STOCK, patented February 9, 1943 by Frederick W. Gaines, 3rd, Cleveland Heights, and William A. Ehlert, South Euclid, Ohio, assignors to The Ajax Manufacturing Company, Euclid, Ohio, a corporation of Ohio.

Drawing, straightening and cutting of the wire stock can all be carried out in the same machine. There are 11 claims.

✦ ✦ ✦

No. 2,310,916, APPARATUS FOR DRAWING AND STRAIGHTENING WIRE STOCK, patented February 9, 1943 by Frederick W. Gaines, 3rd, Cleveland Heights, and William A. Ehlert, South Euclid, Ohio, assignors to The Ajax Manufacturing Company, Euclid, Ohio, a corporation of Ohio.

Skewing, twisting or marring of the wire stock and warping of the blanks or articles fashioned, are prevented.

✦ ✦ ✦

No. 2,311,139, PROCESS FOR THE ELECTROLYTIC CLEANING OF METALS, patented February 16, 1943 by Urlyn Clifton Tainton, Baltimore, Md.

Iron may be subjected to the action of sodium or calcium (as a hydroxide) which metals are considerably more electropositive than iron.

✦ ✦ ✦

No. 2,311,145, SEAT CONSTRUCTION, patented February 16, 1943 by Charles H. Widman, Detroit, and Noble C. Clark, Pleasant Ridge, Mich., assignors to The Murray Corporation of America, Detroit, Mich., a corporation of Delaware.

This construction embodies U-shaped zig-zag wire strip, but the invention is mainly in the disposition of the trim.

✦ ✦ ✦

No. 2,311,256, SPRING CONSTRUCTION, patented February 16, 1943 by Ward T. Sark, Oak Park, Ill., assignor to Haggard and Marcusson Co., Chicago, Ill., a corporation of Illinois.

The object of the invention is to prevent bending of the border portions of the spring construction and stabilizing it.

✦ ✦ ✦

No. 2,311,299, SCREW ELEMENT AND WASHER ASSEMBLY, patented February 16, 1943 by Carl G. Olson, Chicago, Ill., assignor to Illinois Tool Works, Chicago, Ill., a corporation of Illinois.

A protuberance is provided at the upper end of the thread, preventing tracking of the lock washer in the helical space between thread convolutions.

ROBINSON TUBE-TYPE WIRE STRANDERS

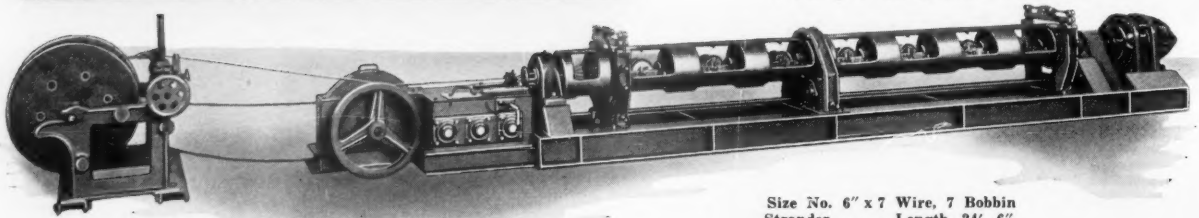
Dynamically Balanced! No Vibration!

ADJUSTABLE CRADLE MOUNTINGS

IN this new Robinson Tube-Type Wire Strander are embodied the suggestions of engineers and operators of numerous wire cable plants throughout the country. As a result of careful study and field contact, this machine now meets the most exacting requirements of the industry. Frame, main and take-off bearing mounts, gear housing and base are of all-welded construction—as structurally stable as though cast in a single unit. Steel tube of high tensile strength is statically and dynamically balanced. Gear box is designed to produce any lay within the range of lays required for its size and type. All high-speed gears are fully enclosed; they operate in a continuous oil bath. Supporting rollers of the best quality highly compressed fibrous material are mounted on spindles running in adjustable ball bearings. Bobbin latches and bobbin brakes are of new design and semi-automatic in operation.

Full information available upon inquiry. Your priority rating may permit of immediate consideration.

Write for Illustrated Manual



Size No. 6" x 7 Wire, 7 Bobbin Strander . . . Length 24' 6" from center of winding reel mounting to end of strander motor. Width of strander 31". Approximate gross weight for domestic shipment 3,000 lbs. Reel stand shipping wgt. 450 lbs.

ROBINSON MANUFACTURING COMPANY

30 CHURCH STREET, NEW YORK, N. Y.

WORKS:—MUNCY, PENNA.

THE UNIQUE MARK

No. 2,311,739, BED OR SIMILAR SPRING, patented February 23, 1943 by Arthur L. Day, Bangor, Maine.

Provision is made for a yieldable construction for supporting the vertical coiled wire springs, with transverse wires, tension springs at their ends and surrounded by lengths of pigtail wires.

✦ ✦ ✦

No. 2,311,775, WIRE DRAWING MACHINE, patented February 23, 1943 by Robert C. Pierce and Leonard G. Berquist, Niles, Mich., assignors to National Standard Company, Niles, Mich., a corporation of Michigan.

New back tensioning (fluid-pressure) means is provided. There are 11 claims.

✦ ✦ ✦

No. 2,311,885, SEAM FOR WOVEN WIRE FABRIC, patented February 23, 1943 by William J. Taylor, Nutley, N. J., assignor to Wilson Wire Works, Inc., Kearny, N. J., a corporation of New Jersey.

In a construction including twisted warp wires, the seam has the ends of the warp wires on each end of the belt soldered together in pairs in the region of the last weft wire, the last weft wire being adjacent to and enclosed by each of the pairs of warp wires and being soldered to the pairs of warp wire ends, the pairs on each end being placed in abutting relation to each other and soldered together to form the seam.

✦ ✦ ✦

No. 2,312,024, INSULATED ELECTRIC CONDUCTOR. patented February 23, 1943 by Grover W. Brown, Fair Lawn, N. J., assignor to The Okonite Company, Passaic, N. J., a corporation of New Jersey.

The conductor is insulated with a compound comprising an initially flexible rubber mechanically mixed with an isobutylene polymer having a molecular weight not less than 30,000 with the polymer in excess.

✦ ✦ ✦

Wire Machinery Manufacturer Changes Name

A. R. PETTERSON, formerly Chief Engineer for the Thomson-Judd Wire Machinery Company of Lynn, Mass., has just announced his purchase of the Company, and the change of its name to **National Wire Machinery Company.**

✦ ✦ ✦

THE offices and plant are now located at the Company's new address: 821 Washington Street, Lynn, to which point the plant was moved last summer. Mr. Petterson, a well-known figure in wire circles, heads the new organization, which in effect is only a change of name.

✦ ✦ ✦

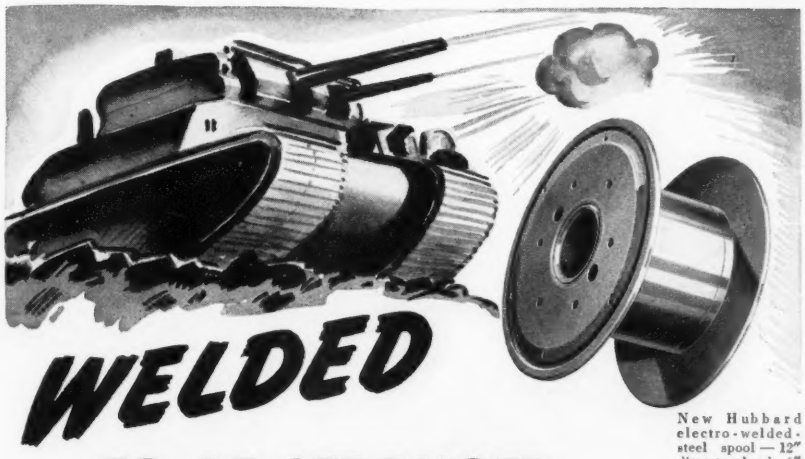
Folder Describes Anti-Rust Compounds

THE Black Bear Company, Inc., has issued a folder which explains the uses and methods of application of Black Bear Anti-Rust "O", and Black Bear Anti-Rust "I". The "O" compound is designed expressly for outdoor use, and the "I" for indoor use only. Both types are widely used for the protection of ferrous and non-ferrous metals for shipment or storage, and are said to differ from other anti-rust compounds in that they leave a dry, durable film that will stand considerable handling. Readers wishing copies of this folder should address requests to: Black Bear Company, Inc., 23-01 44th Drive, Long Island City, New York.

✦ ✦ ✦

Army-Navy "E" to Lindberg

THE Lindberg Engineering Company of Chicago, Illinois, were presented with the Army-Navy Production Award at their offices in Chicago on February 24th. The Company is manufacturing heat treating equipment for war industries, and the award was made to the organization in recognition of outstanding excellence of work in this connection.



WELDED

TO BE STRONGER

AND LAST LONGER!

New Hubbard electro-welded steel spool — 12″ diameter head, 6″ traverse, 7″ diameter barrel.

To America's newest type tanks and Hubbard steel spools and reels, welded construction gives greater strength and rigidity per pound of total unit weight.

An essential advantage in tank operation, such greater strength is also important in your wire production operations. Hubbard steel spools and reels, electro-welded wherever formed parts are joined, can better withstand the rough usage and wear of today's war time production pace. Designed and balanced for smooth vibration-free rotation, the dependable, long life of Hubbard equipment has been demonstrated and proved in every step of wire manufacture where spools and reels are used.

You are invited to write for the full facts on Hubbard products and methods. Our engineers will be happy to work with you on the proper selection and design of spools and reels for any operation for any type of wire, either copper or steel.

HUBBARD SPOOL COMPANY

1624 CARROLL AVENUE | CHICAGO, ILLINOIS

Since 1912, manufacturers of wire drawing and annealing, and shipping spools and reels.

Steel Conductors for Transmission And Distribution of Electric Power

(*Continued from Page 220*)

supports will be increased by expansion due to heating; likewise if the temperature decreases, the length of wire will decrease by contraction due to cooling. The change in length can be calculated from the coefficient of linear expansion, by well-known methods. After the change in length due to temperature change has been calculated, the new sag and tension can be determined by application of the usual catenary formulas.

✦ ✦ ✦

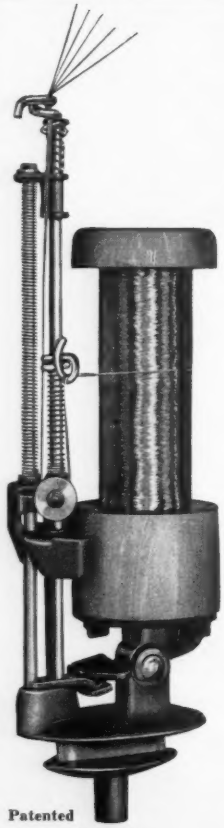
IT also is necessary to calculate the sag and tension when ice and/or wind loads are applied to the suspended wire. The ice and wind loading used in such calculations is specified for the various parts of the country in the **National Electrical Safety Code,** which is published by the **National Bureau of Standards, for the American Standards Association.** When ice forms on the suspended wire the weight of the wire increases and this in turn causes increased sag due both to elastic stretch and to slight creep of the wire under sustained loads. The amount of the elastic stretch can be calculated from Young's modulus for the particular steel wire involved but creep must be determined experimentally. It has not been generally recognized heretofore that a very small amount of creep occurs in steel at ordinary temperatures with tensions below the so-called proportional limit, but it is now known that it exists in all overhead wires and that it is generally of greater magnitude in non-ferrous materials.

✦ ✦ ✦

THIS creep or permanent stretching of wire at ordinary temperatures when subjected to sustained tensions below the elastic limit has been carefully explored by many laboratory tests. In these tests constant loads of 20, 30, 40, 50 and 60 percent of the ultimate breaking strength of the wire were applied, holding each load for a period of at least 24 hours, and usually until stretching ceased. Generally it has been found that creep in steel wire virtually ceases by the end of 24 hours, unless the sustained loads are materially in excess of 60 percent of the ultimate strength. Steel is much superior in this respect to non-ferrous metals.

✦ ✦ ✦

THE amount of creep which occurs at the maximum load to which a suspended wire is stressed should be taken into consideration in calculating the final sags and tensions. These computations are somewhat complicated and the results are only approximate at best. An accurate graphic method has



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been developed for the determination of the initial stringing sags and tensions, and also the final loaded and unloaded sags and tensions, for the usual out-of-door temperatures. This graphic method employs a series of catenary curves in conjunction with a stress-strain curve established by careful physical tests. The stress-strain curve should be determined from the results of several tests on the particular size and type of conductor under consideration. This graphic method is very flexible and also is the most accurate method yet devised; it furthermore provides an excellent record and can be checked readily.

✦ ✦ ✦

THE sags and tensions for all types of overhead conductors should be determined carefully, as the minimum permissible clearances above ground of various classes of electric power lines are specified in the National Electrical Safety Code mentioned earlier. This Code has been adopted by many states, and is virtually incorporated in their laws. The fifth edition of the Safety Code was adopted in 1941 and includes numerous changes from the fourth edition, especially with regard to clearances and also in the matter of ice and wind loadings. A caution against any further use of the fourth edition of the Code is probably in order at this time.

✦ ✦ ✦

Typical Installations of Steel Conductors

SINCE their introduction about six years ago, the HTC-130 Steel Conductors have been used in all parts of the United States. These steel conductors have been used extensively for the branches of rural distribution lines operated at 12,000 volts 3-phase or 6900 volts single-phase. Fig. 9 and Fig. 10 show some typical installations of these conductors for rural power lines.

✦ ✦ ✦

STEEL conductors are not very satisfactory for low voltage lines (115 or 230 volts) because

(*Please turn to Page 242*)

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Because They're Made of

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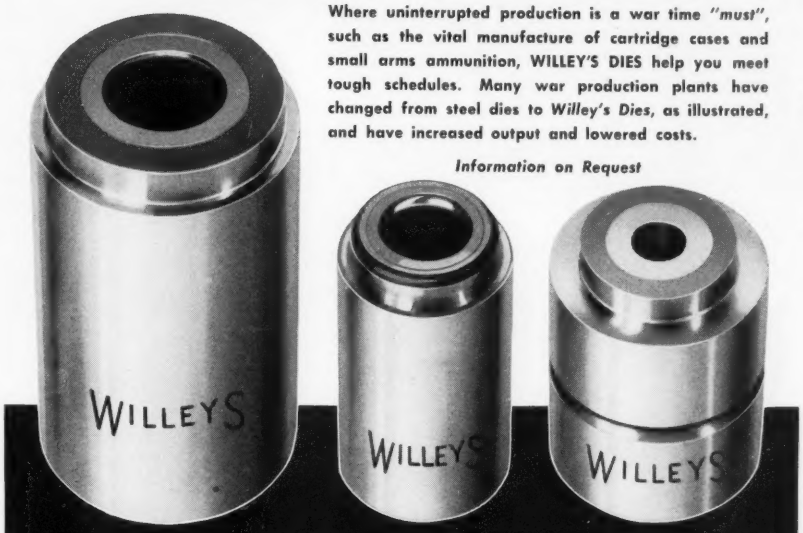

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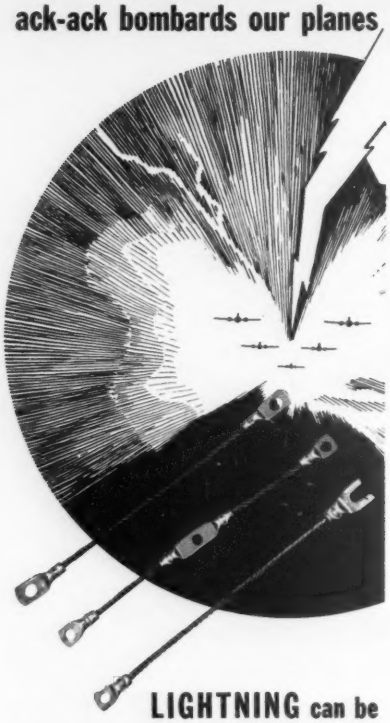
ack-ack bombards our planes



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CALLITE WIRES

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Reg. U. S. Pat. Off.

A FINE WIRE FOR EVERY NEED

Steel Conductors for Transmission And Distribution of Electric Power

(*Continued from Page 241*)

of the relatively high amperage, unless the load is quite small. Their use is also somewhat restricted on 2300-volt distribution systems for similar reasons.

✦ ✦ ✦

STEEL conductors are being used very successfully for moderately loaded transmission lines. One example of such application is a 44,000-volt 3-phase line erected in Utah in 1939 for transmitting 600 kva a distance of 35 miles.

✦ ✦ ✦

THE combination of high tensile strength with relatively low 60-cycle resistance and reactance afforded by **Crapo Steel Conductors** makes them especially applicable to high-voltage distribution and transmission. The special steel and the special treatment during the processing combine to provide superior electrical properties, high fatigue strength and resistance to shock. The **Indiana Steel and Wire Company** has developed and published extensive technical data for the application of these HTC Steel Conductors. These data, which made the successful application of these steel conductors possible during peace time, have been very valuable to power transmission engineers during the present emergency, when the supply of conductor materials has been so critical.

✦ ✦ ✦

Wire Plant Moves

W. H. MacDONALD, President of the Spencer Wire Company of Spencer, Mass., has announced the removal of the Company's manufacturing facilities to its new and modern plant at West Brookfield. The move to the new plant, designed for the production of fine sizes of steel and alloy wires took place on March 1st. At present the Company's production is confined to war work.

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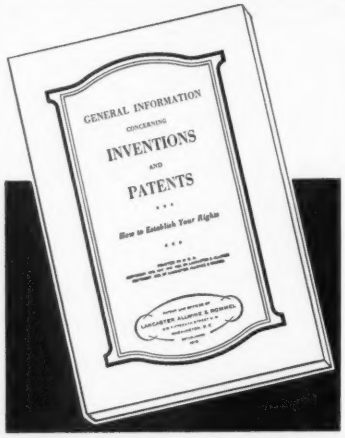

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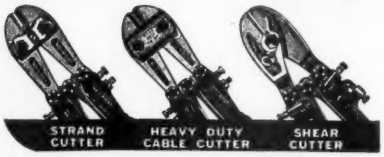

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De Profundis

(*Continued from Page 229*)

something tells me that when they get back they may take over the labor problem themselves and settle it Commando fashion.

✦ ✦ ✦

EVERY once in a while, the President or one of his stooges, after fanfares, and a great clearing of the networks, announces a labor policy to end all labor policies. Before his voice has died away about seventeen commentators are on the air, picking his words apart to see what they mean. They remind me of the old Roman sooth-sayers who used to foretell the future by examining the entrails of birds. They get just the same results, too, seventeen different meanings, and take your choice.

✦ ✦ ✦

MATTER of fact, its no use trying to take that stuff at face value. A presidential decree on labor matters reminds me of Andrew H. Brown's complaint about insurance policies. "De big print gives it to you and de little print takes it away." Our president talks cold turkey to manufacturers, but when he talks to labor he has his legal staff around him.

✦ ✦ ✦

Q. Mr. Whoosis, may I tell you what my editor says about you without giving offense?

✦ ✦ ✦

A. You can try it.

✦ ✦ ✦

Q. Well, I'll probably get slugged for this, but he says that a lot of people complain that you criticize the government without suggesting any remedies. They want something constructive.

✦ ✦ ✦

A. My dear fellow, can't they see that the remedies are implicit in the criticisms? Do they want me to dot all the i's, and cross all the t's? I know that is necessary in legal documents, but after all, this is literature, or is it? If it is, then one of the cardinal rules is to leave something to the imagina-

(*Please turn to Page 248*)

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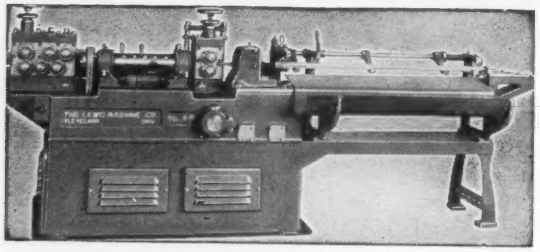

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CORRECTION NOTICE

In using the chart published in the March Issue and furnished by the Watson Machine Company as a guide for the manufacture of electric cable, it has been found that in order to accomplish the desired purpose of giving a direct reading on the tape angles and pitch for various lapping diameters and tape widths that it is necessary to superimpose an additional set of curves on those shown in the chart published.

Any reader of this publication desiring a copy of the new and revised chart may obtain this without cost by addressing the Editor of WIRE & WIRE PRODUCTS.

De Profundis

(*Continued from Page 247*)

tion of the reader. Now let's go back over this interview and see how that works out.

✦ ✦ ✦

FIRST I explained how Mr. Roosevelt got to be the way he is. I mentioned the tit-willies and the godsakers. Notice how nimbly I skipped around the president's name to avoid identifying him definitely with these groups. After all, I am, in a sense, a guest of the administration here and I mustn't abuse my host. But how can the reader escape the inference that if our well-being, which is firmly based on a capitalistic form of society, is being steadily sapped and abused by a horde of appointees who never have functioned in a normal way in any productive system, who despise the capitalistic system for personal reasons, and who show unmistakable signs of a desire to try some alien system, then the obvious remedy is to fire these pansies and replace them with a bunch of hairy apes who know how many pennies there are in a dollar, and know every one by its first name, who have sweated, and saved, and denied themselves to get a foothold on the ladder, gone broke, brushed themselves off and started over again, and finally made the grade. I want my interests looked after by somebody who has been successful in looking after his own. I should like to be able to say to my employee "Thou hast been faithful in few things; I will make thee ruler over many things."

✦ ✦ ✦

WHAT I said about rationing you can forget. Why try to gild the lily? I spoke of the persistent efforts of New Dealers to discredit capitalism and dilute it with practices which even Russian communists are abandoning. I hinted that the labor situation was getting very close to an impasse. Can anyone escape the inference that if in each of these vital matters our authorities are harrying us in the wrong direction, and are still unconscious of their error after ten long years,

the sole remedy is to ditch every last one of them and replace them? This includes every damned New Dealer, whether administration, policy maker, or under-strapper, and for two cents I'd throw in the democratic party, which bred them, nourishes them and rides on their coat-tails. Let's be frank and honest; let's start with Roosevelt, who inspires the whole team.

✦ ✦ ✦

A. You are speaking of your host, Mr. Whoosis!

✦ ✦ ✦

A. Well, all right, let him throw me out of here, I can take it. I want to make a suggestion. When we eliminate Mr. Roosevelt next year, let us take a leaf from the book of the N.L.R.B., let's make it retro-active to March 4, 1933. Let the new Congress, as its first act, pass a law nullifying everything that's been done since then. Whatever is needful can be re-enacted in a couple of hours. I can't think of anything, but let's be liberal and say two hours.

✦ ✦ ✦

Q. Why Mr. Whoosis, you shock me! Surely you won't deny that some things the New Deal has done have been beneficial?

✦ ✦ ✦

A. What things?

✦ ✦ ✦

Q. Lots of things.

✦ ✦ ✦

A. Name three.

✦ ✦ ✦

Q. What?

✦ ✦ ✦

A. I said name three. Well, what are you waiting for? Name three.

✦ ✦ ✦

Q. Well don't hustle me; can't you give me time to think?

✦ ✦ ✦

A. Ha ha! Do you know, son, I've tried that trick on a lot of soft-hearted people, and nobody ever got beyond two. Now here's a sporting proposition. You go home and make a list of all the things the New Deal has done that have been beneficial. Take your time. Bring the list back here some time. Set them up for me,

(*Please turn to Page 250*)

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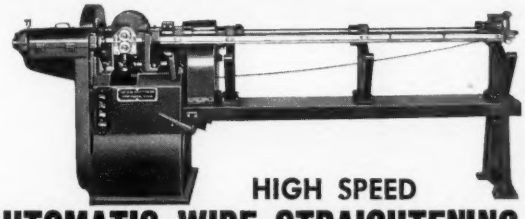

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De Profundis

(*Continued from Page 249*)

one at a time, and as fast as you set them up I'll knock them down. Are you on?

✦ ✦ ✦

Q. Splendid, Mr. Whoosis, I'll come back.

✦ ✦ ✦

A. Always glad to see you my boy. I'd do it right now but I know you'll need a long time to prepare your list. And I hear the turnkey stamping around in the corridor, it's getting near his supper time, so I'll have to say goodbye. Remember me to your Editor and come back soon.

✦ ✦ ✦

General Meeting, May 27, 1943

THE Fifty-Second General Meeting of American Iron and Steel Institute will be held at The Waldorf-Astoria, New York City, on Thursday, May 27, 1943.

✦ ✦ ✦

IT has been decided to limit the meeting this year to the general session in the morning and the special sessions in the afternoon, and to **omit the evening banquet from the program.**

✦ ✦ ✦

AS has been the case for several years, attendance will be restricted to individual members of the Institute. Program and further details of the meeting will be announced at a later date.

✦ ✦ ✦

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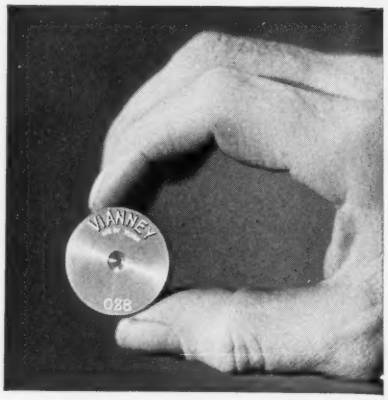

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✦ ✦ ✦

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✦ ✦ ✦

A. Dale Mitchell, Controller, Waterbury-Farrel Fdry. & Machine Company

A. DALE MITCHELL, formerly associated with Barrow, Wade, Guthrie & Co., Public Accountants and Auditors, has been named Controller of the Waterbury Farrel Foundry & Machine Co., machinery builders, Waterbury, Connecticut. Mr. Mitchell succeeds **William M. Birs**, former Assistant Treasurer, who resigned December 1, 1942.

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Army-Navy "E" to C. O. Jelliff Mfg. Corp.

THE C. O. Jelliff Mfg. Corp., Southport, Conn., was presented with the Army-Navy Production Award on February 9, 1943 in recognition of its record in the production of vital war materials. The ceremonies were attended by two officials, Army and Navy representatives and the entire personnel of the company.

✦ ✦ ✦

LIEUT.-COL. **Howard D. Norris**, Army Air Corps, presented the Army-Navy "E" pennant which now flies over the company's plant. **Henry H. Rennell**, secretary and general manager, accepted on behalf of the company, paying special tribute to the Jelliff men who had left for service in the armed forces. **Robert Schwal** accepted the "E" pins on behalf of his fellow-workers.

✦ ✦ ✦

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Successors to
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Write for Catalogue

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WHERE TO BUY

For more complete information, consult the annual Wire and Wire Products Directory, Index & Buyers' Guide.

ABRASIVES—
Norton Co., Worcester, Mass.

ACID INHIBITORS—
American Chemical Paint Co., Ambler, Pa.

AIR DRAW FURNACES—
Carl-Mayer Corp., The, Cleveland, Ohio.

ALKALINE CLEANERS—
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.

ANNEALING MACHINES—Open Flame
Syncro Machine Co., Rahway, N. J.

ANNEALING POTS AND BOXES—
National Annealing Box Co., Washington, Penna.
Scudder, E. J., Foundry & Machine Co., Trenton, N. J.

ARMORING EQUIPMENT—
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

BAKERS—FLASH
Morrison Engr. Corp., Cleveland, Ohio

BAKERS—Hi-Speed
Carl-Mayer Corp., The, Cleveland, Ohio.

BAKERS—Rod and Wire
Carl-Mayer Corp., The, Cleveland, Ohio.
Morgan Construction Co., Worcester, Mass.
Morrison Engr. Corp., Cleveland, Ohio
Moslo Machinery Co., Cleveland, Ohio.
Ross, J. O., Engineering Corp., New York, N. Y.

BENDERS—
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

BERYLLIUM COPPER — Strip and Bars
Callite Tungsten Corp., Union City, N. J.

BOBBINS—Braider and Wire Weaving
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

BORON CARBIDE—
Norton Co., Worcester, Mass.

BRAKES & SHEARS—
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

CABLE LACQUERING OVENS
Industrial Oven Engr. Co., Cleveland, Ohio.

CARRIERS—Braider, High Speed
Apco Mossberg Co., Attleboro, Mass.
Carter, B. & F., & Co., Ltd., Bolton, England.
Mossberg Pressed Steel Corp., Attleboro, Mass.

CEMENTS—Refractory
Norton Co., Worcester, Mass.

CHEMICALS—Cleaning
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Oakite Products, Inc., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

CLEANERS—Hand and Metal
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Oakite Products, Inc., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

CLEANING & PICKLING EQUIPMENT—
Broden Construction Co., Cleveland, O.
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio.
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

CLOTH TESTERS—
Scott, Henry L., Co., Providence, R. I.

CLOTH—Wire, All Metals
Callite Tungsten Corp., Union City, N. J.

WHERE TO BUY, Continued

COATING COMPOUNDS—
Apex Alkali Products Co., Philadelphia, Pa.
Gilron Products Co., Cleveland, Ohio
Standard Industrial Compounds Co., Chicago, Ill.

COILERS—Sheet, Strip and Wire
Broden Construction Co., Cleveland, O.
Ruesch, H. J., Machine Co., Newark, N. J.
Torrington Mfg. Co., Torrington, Conn.

COLD HEADERS—
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

COMPOUNDS—Coppering
American Chemical Paint Co., Ambler, Pa.

COMPOUNDS—Metal Finishing
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.

COMPOUNDS—Rust Preventing
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.

COMPOUNDS—Rust Removing
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.

COMPOUNDS—Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Gilron Products Co., Inc., Cleveland, Ohio.
Oakite Products, Inc., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

CONTROLS—Heat Treating
Niagara Blower Co., Buffalo, N. Y.

CONTROLS—Temperature
Niagara Blower Co., Buffalo, N. Y.

COPHOLDERS—Steel
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

CRANES—Wire Mill
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio.
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

CUTTING TOOLS—Carbide
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Vascoloy-Ramet Corp., North Chicago, Ill.

CUTTING TOOLS—Wire
Porter, H. K., Inc., Everett, Mass.

DIAMONDS—Industrial
Callite Tungsten Corp., Union City, N. J.

DIAMOND POWDERS—
Rusch Wire Die Corp., New York, N. Y.

DIAMOND TOOLS—
Rusch Wire Die Corp., New York, N. Y.

DIE MAKING MACHINERY — For Forming Special Shapes
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

DIES—Diamond
Ajax Industrial Supplies, Inc., Fort Wayne, Ind.
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Cochaud Wire Die Corp., New York, N. Y.
Fort Wayne Wire Die, Inc., Fort Wayne, Ind.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Krause, F., & Co., Hillside, N. J.
Luginbill Wire Die Co., Fort Wayne, Ind.
Rusch Wire Die Corp., New York, N. Y.
Vianney Wire Die Works, New York, N. Y.
Wayne Wire Die Co., Hillside, N. J.

DIES—Lead Extrusion
Robertson, John, Co., Brooklyn, N. Y.

DIES—Repairs & Re-Cutting
Ajax Industrial Supplies Co., Fort Wayne, Ind.
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Carboloy Co., Inc., Detroit, Mich.
Cochaud Wire Die Corp., New York, N. Y.
Firth-Sterling Steel Co., McKeesport, Pa.
Fort Wayne Wire Die, Inc., Fort Wayne, Ind.
Kelly Wire Die Corp., New York. N. Y.
Krause, F., & Co., Hillside, N. J.
Luginbill Wire Die Co., Fort Wayne, Ind.
Rusch Wire Die Corp., New York, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Works, New York, N. Y.
Wayne Wire Die Co., Hillside, N. J.
Willey's Carbide Tool Co., Detroit, Mich.

DIES—Rod and Tube Drawing
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Kelly Wire Die Corp., New York, N. Y.
Rusch Wire Die Corp., New York, N. Y.
Tungsten Electric Corp., Union City, N. J.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Works, New York, N. Y.
Willey's Carbide Tool Co., Detroit, Mich.

DIES—Tantalum Carbide
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Kelly Wire Die Corp., New York, N. Y.
Rusch Wire Die Corp., New York, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Works, New York, N. Y.
Willey's Carbide Tool Co., Detroit, Mich.

DIES—Tungsten Carbide
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Kelly Wire Die Corp., New York, N. Y.
Rusch Wire Die Corp., New York, N. Y.
Tungsten Electric Corp., Union City, N. J.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Works, New York, N. Y.
Willey's Carbide Tool Co., Detroit, Mich.

DRAW BENCHES—
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Foundry & Machine Co., Trenton, N. J.
Standard Machinery Co., Providence, R. I.
Vaughn Machinery Co., Cuyahoga Falls, O.

DRUMS—Flange Steel
Stevens Metal Products Co., Niles, O.

DRUMS—Vulcanizing
Mossberg Pressed Steel Corp., Attleboro, Mass.

DRYING EQUIPMENT—
Niagara Blower Co., Buffalo, N. Y.

ENGINEERS—Consulting Wire Mill
Hartley, George D., Worcester, Mass.
Lewis, Kenneth B., Worcester, Mass.

EQUIPMENT—Humidifying
Niagara Blower Co., Buffalo, N. Y.

EQUIPMENT—Industrial Cooling
Niagara Blower Co., Buffalo, N. Y.

EQUIPMENT—Insulation Testing
Davis, R. L., Electric Co., Wallingford, Conn.

EYELETS—Brass or Zinc
Platt Bros. & Co., The, Waterbury, Conn.

FLUXES—Soldering
American Chemical Paint Co., Ambler, Pa.

FOAM PRODUCING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.

FURNACES—Annealing
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, O.
Rockwell, W. S., Co., New York, N. Y.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.

FURNACES—Automatic
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, O.
Rockwell, W. S., Co., New York, N. Y.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.

FURNACES—Brazing
Electric Furnace Co., Salem, O.
Firth-Sterling Steel Co., McKeesport, Pa.

FURNACES—Bright Annealing
Electric Furnace Co., Salem, O.
Rockwell, W. S., Co., New York, N. Y.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.

FURNACES—Electric
Electric Furnace Co., Salem, Ohio
Rockwell, W. S., Co., New York, N. Y.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio

FURNACES—Hardening & Tempering
Carl-Mayer Corp., The, Cleveland, Ohio
Electric Furnace Co., Salem, Ohio
Rockwell, W. S., Co., New York, N. Y.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio

FURNACES—Lead Melting
Electric Furnace Co., Salem, Ohio
Robertson, John, Co., Brooklyn, N. Y.

FURNACES—Non-Oxidizing
Carl-Mayer Corp., The, Cleveland, Ohio
Electric Furnace Co., Salem, Ohio
Rockwell, W. S., Co., New York, N. Y.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio

FURNACES—Normalizing
Carl-Mayer Corp., The, Cleveland, Ohio
Electric Furnace Co., Salem, Ohio
Rockwell, W. S., Co., New York, N. Y.

FURNACES—Salt Bath
Electric Furnace Co., Salem, Ohio
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.

FURNACES—Wire, Strip & Sheet
Carl-Mayer Corp., The, Cleveland, Ohio
Electric Furnace Co., Salem, Ohio
Rockwell, W. S., Co., New York, N. Y.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.

GALVANIZING KETTLES—
National Annealing Box Co., Washington, Penna.

GRINDERS—Roll
Norton Co., Worcester, Mass.

HI-SPEED BAKERS—
Carl-Mayer Corp., The, Cleveland, Ohio

HOISTS—Electric Travelling
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.

INHIBITORS—
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.

KETTLES—Galvanizing, Annealing, Tinning, etc.
National Annealing Box Co., Washington, Penna.

LATHES—Die Reaming
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

LUBRICANTS—For Metal Cutting, Stamping and Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Standard Industrial Compounds Co., Chicago, Ill.

LUBRICANTS—Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Bick, Hans C., Inc., Reading, Pa.
Oakite Products, Inc., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

MACHINERY—Armoring (Cable, Wire Hose)
American Insulating Mach'y. Co., Phila., Pa.
National Wire Machinery Co., Lynn, Mass.
New England Butt Co., Providence, R. I.
Robertson, John, Co., Brooklyn, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Braiding
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Robinson Mfg. Co., Muncy, Pa.
Watson Machine Co., Paterson, N. J.

MACHINERY—Brazing
National Wire Machinery Co., Lynn, Mass.

MACHINERY—Bunching
American Insulating Mach'y. Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Bundling, Scrap
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Watson Machine Co., Paterson, N. J.

MACHINERY—Cable, Electric
American Insulating Mach'y. Co., Phila., Pa.
Fidelity Machine Co., Philadelphia, Pa.
National Wire Machinery Co., Lynn, Mass.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Chain Making
Nilson, A. H., Machine Co., The, Bridgeport, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Closing
New England Butt Co., Providence, R. I.
Robinson Mfg. Co., Muncy, Pa.
Watson Machine Co., Paterson, N. J.

MACHINERY—Coil Winding
Robinson Mfg. Co., Muncy, Pa.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.

MACHINERY—Coilers
Broden Construction Co., Cleveland, Ohio
Morgan Construction Co., Worcester, Mass.

WHERE TO BUY, Continued

New England Butt Co., Providence, R. I.
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., Torrington, Conn.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Copper Wire Drawing and Rolling
Ruesch, H. J., Machine Co., Newark, N. J.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Covering Wire
Fidelity Machine Co., Philadelphia, Pa.
Syncro Machine Co., Rahway, N. J.

MACHINERY—Cutting
Broden Construction Co., Cleveland, Ohio
Lewis Machine Co., The, Cleveland, Ohio
Moslo Machinery, Inc., Cleveland, Ohio
National Machinery Exchange (Used), New York, N. Y.
Nilson, A. H., Machine Co., The, Bridgeport, Conn.
Shuster, F. B., Co., New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Die Making
Firth-Sterling Steel Co., McKeesport, Pa.

MACHINERY — Die Making for Forming Special Shapes
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

MACHINERY—Draw Benches
Standard Machinery Co., Providence, R. I.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Edging
Standard Machinery Co., Providence, R. I.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Enameling
American Insulating Mach'y. Co., Phila., Pa.
Syncro Machine Co., Rahway, N. J.

MACHINERY—Extruding
National Erie Corp., Erie, Pa.
Robertson, John, Co., Brooklyn, N. Y.
Royle, John, & Sons, Paterson, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Flat Wire
Broden Construction Co., Cleveland, Ohio
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Forming
National Machinery Exchange (Used), New York, N. Y.
Nilson, A. H., Machine Co., The, Bridgeport, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Galvanizing Wire
Broden Construction Co., Cleveland, O.
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Gang Winders
Fidelity Machine Co., Philadelphia, Pa.
Robinson Mfg. Co., Muncy, Pa.
Ruesch, H. J., Machine Co., Newark, N. J.
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Grinding
Norton Co., Worcester, Mass.

MACHINERY—Insulating
American Insulating Mach'y Co., Phila., Pa.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Royle, John, & Sons, Paterson, N. J.
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Knitting
Fidelity Machine Co., Philadelphia, Pa.

MACHINERY—Lead Encasing Presses, etc.
Robertson, John, Co., Brooklyn, N. Y.

MACHINERY—Lead Stripping
Robertson, John, Co., Brooklyn, N. Y.
Watson Machine Co., Paterson, N. J.

MACHINERY—Lock Washer
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Magnet Wire
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Material Handling
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio.

MACHINERY — Measuring Wire & Cable
Davis, R. L., Electric Co., Wallingford, Conn.
Durant Mfg. Co., Milwaukee, Wis.
Lyon-Vail Machine Co., Brockton, Mass.
New England Butt Co., Providence, R. I.
Robinson Mfg. Co., Muncy, Pa.
Watson Machine Co., Paterson, N. J.

MACHINERY—Nail and Tack
Glader, Wm., Machine Works, Chicago, Ill.
National Machinery Exchange (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Panning
American Insulating Mach'y Co., Phila., Pa.
Syncro Machine Co., Rahway, N. J.

MACHINERY—Pointing
Broden Construction Co., Cleveland, Ohio
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Quill Winding
Fidelity Machine Co., Philadelphia, Pa.

MACHINERY—Rod Mill
Broden Construction Co., Cleveland, Ohio
Morgan Construction Co., Worcester, Mass.
Ruesch, H. J., Machine Co., Newark, N. J.

MACHINERY—Rolling Mill
Broden Construction Co., Cleveland, Ohio
Morgan Construction Co., Worcester, Mass.
National Machinery Exchange (Used), New York, N. Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Standard Machinery Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., Torrington, Conn.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Rubber for Insulating Wire
National Erie Corp., Erie, Pa.
Royle, John, & Sons, Paterson, N. J.

MACHINERY—Rubber Strip Covering
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Rubber Tubing and Straining
New England Butt Co., Providence, R. I.
Royle, John, & Sons, Paterson, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Screw Wire
National Machinery Exchange (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Special
American Insulating Mach'y Co., Phila., Pa.
Broden Construction Co., Cleveland, Ohio
Emory, Robert J., Co., Newark, N. J.
New England Butt Co., Providence, R. I.
Robinson Mfg. Co., Muncy, Pa.
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I. (Special Designs)
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Spooling
American Insulating Mach'y Co., Phila., Pa.
Emory, Robert J., Co., Newark, N. J.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Robinson Mfg. Co., Muncy, Pa.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Spring Making
National Machinery Exchange (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Staple
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Straightening
Broden Construction Co., Cleveland, Ohio
Lewis Machine Co., The, Cleveland, Ohio
Moslo Machinery Co., Cleveland, Ohio
National Machinery Exchange (Used), New York, N. Y.
Nilson, A. H., Machine Co., The, Bridgeport, Conn.
Ruesch, H. J., Machine Co., Newark, N. J.
Shuster, F. B., Co., New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Stranding
National Wire Machinery Co., Lynn, Mass.
New England Butt Co., Providence, R. I.
Robinson Mfg. Co., Muncy, Pa.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Strip Steel
Broden Construction Co., Cleveland, Ohio
Ruesch, H. J., Machine Co., Newark, N. J.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Swaging
National Machinery Exchange (Used), New York, N. Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Taping
American Insulating Mach'y Co., Phila., Pa.
Fidelity Machine Co., Philadelphia, Pa.
National Wire Machinery Co., Lynn, Mass.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Testing
Robinson Mfg. Co., Muncy, Pa.
Scott, Henry L., Co., Providence, R. I.

MACHINERY—Testing Size of Wire
Davis, R. L., Electric Co., Wallingford, Conn.

MACHINERY—Testing Spring
Standard Machinery Co., Providence, R. I.

MACHINERY—Tinsel Rolling Mills
American Insulating Mach'y Co., Phila., Pa.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Trolley Wire
Vaughn Machinery Co., Cuyahoga Falls, O.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Tube Mill
Ruesch, H. J., Machine Co., Newark, N. J.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Welding Wire
Micro Products Co., Chicago, Ill.
National Wire Machinery Co., Lynn, Mass.
Shuster, F. B., Co., New Haven, Conn.

MACHINERY—Winding
American Insulating Mach'y Co., Phila., Pa.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Bending
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

MACHINERY—Wire Drawing
American Insulating Mach'y Co., Phila., Pa.
Broden Construction Co., Cleveland, Ohio
Morgan Construction Co., Worcester, Mass.
National Machinery Exchange (Used), New York, N. Y.
National Wire Machinery Co., Lynn, Mass.
Robinson Mfg. Co., Muncy, Pa.
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Wire Measuring
Durant Mfg. Co., Milwaukee, Wis.
Lyon-Vail Machine Co., Inc., Brockton, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Rope
National Wire Machinery Co., Lynn, Mass.
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

WHERE TO BUY, Continued

MACHINERY—Wire Tinning
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.

MACHINERY—Wood Screw
National Machinery Exchange (Used), New York, N. Y.

MATERIAL HANDLING EQUIPMENT
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.

MILLS—Tandem Rolling and Edging
Standard Machinery Co., Providence, R. I.
Torrington Mfg. Co., Torrington, Conn.

NICKEL SILVER AND PHOSPHOR BRONZE—Rod, Wire and Strip
Hudson Wire Co., Ossining, N. Y.

OILS—Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Standard Industrial Compounds Co., Chicago, Ill.

OVENS—Cable Lacquering
Industrial Oven Engr. Co., Cleveland, Ohio

OVENS—Industrial
Carl-Mayer Corp., The, Cleveland, Ohio
Industrial Oven Engr. Co., Cleveland, Ohio
Ross, J. O., Engineering Corp., New York, N. Y.

PAINTS—Heat Resisting
American Chemical Paint Co., Ambler, Pa.

PAINTS—Marine
American Chemical Paint Co., Ambler, Pa.

PAINTS—Structural Steel
American Chemical Paint Co., Ambler, Pa.

PANS—Lead and Spelter
National Annealing Box Co., Washington, Penna.

PANS—Vulcanizing
Mossberg Pressed Steel Corp., Attleboro, Mass.

PAPER—Creped Wrapping
Crepe-Kraft Co., Newark, N. J.

PAPER TESTERS—
Scott, Henry L., Co., Providence, R. I.

PATENT ATTORNEYS—
Lancaster, Allwine and Rommel, Washington, D. C.

PICKLING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.

PLASTIC TESTERS—
Scott, Henry L., Co., Providence, R. I.

POTS—Lead Melting
Robertson, John, Co., Brooklyn, N. Y.

POWDER—Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.

PRESSES—Hydraulic and Mechanical
Robertson, John, Co., Brooklyn, N. Y.
Standard Machinery Co., Providence, R. I. (Mechanical Only)

PRESSES—Lead
Robertson, John, Co., Brooklyn, N. Y.

PRESSURE VESSELS—
National Annealing Box Co., Washington, Penna.

PULLERS—Wire
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.

PUMPS—Hydraulic
Robertson, John, Co., Brooklyn, N. Y.

QUENCHING BATH CONTROLS—
Niagara Blower Co., Buffalo, N. Y.

REEL AND TENSION STAND—
Fidelity Machine Co., Philadelphia, Pa.
Moslo Machinery Co., Cleveland, Ohio
Robinson Mfg. Co., Muncy, Pa.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.

REEL CRUTCHES—
Watson Machine Co., Paterson, N. J.

REELS—Annealing and Stranding
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Moslo Machinery Co., Cleveland, Ohio
Mossberg Pressed Steel Corp., Attleboro, Mass.
Shuster, F. B., Co., New Haven, Conn.
Stevens Metal Products Co., Niles, O.

REELS—Steel
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

REELS AND SPOOLS—Shipping and Shop
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

REELS—Takeoff
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Moslo Machinery Co., Cleveland, Ohio
Mossberg Pressed Steel Corp., Attleboro, Mass.
Shuster, F. B., Co., New Haven, Conn.
Stevens Metal Products Co., Niles, O.

REELS—Vulcanizing and Impregnating
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Shuster, F. B., Co., New Haven, Conn.
Stevens Metal Products Co., Niles, O.

REELS—Wire Drawing
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Moslo Machinery Co., Cleveland, Ohio
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

REFRACTORIES—High Temperature
Norton Co., Worcester, Mass.

ROD BAKERS—
Carl-Mayer Corp., The, Cleveland, Ohio
Moslo Machinery Co., Cleveland, Ohio
Ross, J. O., Engineering Corp., New York, N. Y.

RODS—Wire—Non-Ferrous
Hudson Wire Co., Ossining, N. Y.
Platt Bros. & Co., The, Waterbury, Conn.

RODS—Wire—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Indiana.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.

ROLL STRAIGHTENERS—
Moslo Machinery Co., Cleveland, Ohio

RUBBER AND RUBBER COMPRESSION TESTERS—
Scott, Henry L., Co., Providence, R. I.

RUST PROOF COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.

RUST REMOVING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.

SHEARS—
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

SHEET—Steel
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.

SOAPS—Industrial and Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Standard Industrial Compounds Co., Chicago, Ill.

SPOOLS—Annealing and Wire Drawing
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

SPOOLS—Shipping and Shop
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

SPOOLS—Steel
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

STAMPINGS—Steel
Hubbard Spool Co., Chicago, Ill
Mossberg Pressed Steel Corp., Attleboro, Mass.

STRIP—Brass and Non-Ferrous
Hudson Wire Co., Ossining, N. Y.

STRIP—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.

STRIP METAL TESTERS—
Scott, Henry L., Co., Providence, R. I.

SWIFTS—Take-off
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.

TANKS—Compound
Watson Machine Co., Paterson, N. J.

TANKS—Steel
Mossberg Pressed Steel Corp., Attleboro, Mass.

TEMPERATURE CONTROLS—
Niagara Blower Co., Buffalo, N. Y.

TENSILE TESTERS—
Scott, Henry L., Co., Providence, R. I.

TESTING INSTRUMENTS—
Scott, Henry L., Co., Providence, R. I.

TOOLS—Wire Cutting
Porter, H. K., Inc., Everett, Mass.

TRAMRAIL SYSTEMS—
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.

TREADS—Safety
Norton Co., Worcester, Mass.

TRUCKS—
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

TUBE BENDERS AND FORMERS—
Ruesch, H. J., Machine Co., Newark, N. J.

TURKS HEADS—Friction and Power Driven
Standard Machinery Co., Providence, R. I.

VULCANIZERS—
Watson Machine Co., Paterson, N. J.

VULCANIZING PANS—
American Insulating Mach'y Co., Phila., Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.

WELDERS—Spot and Butt
Micro Products Co., Chicago, Ill.
Moslo Machinery Co., Cleveland, Ohio

WIRE—Cold Heading
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Indiana.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.

WIRE—Electric
Hudson Wire Co., Ossining, N. Y.

WIRE—Enameled for Coils
Winsted Div. of Hudson Wire Co., Winsted, Conn.

WIRE—Manufacturers
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.

WIRE—Music
Jersey Steel & Wire Corp., Irvington, N. J.

WIRE—Nickel Silver and Phosphor Bronze
Callite Tungsten Corp., Union City, N. J.
Hudson Wire Co., Ossining, N. Y.

WIRE—Non-Ferrous to Specification for Special Purposes
Callite Tungsten Corp., Union City, N. J.
Hudson Wire Co., Ossining, N. Y.
Winsted Div. of Hudson Wire Co., Winsted, Conn.

WIRE—Spring
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.

WIRE—Stainless Steel
Callite Tungsten Corp., Union City, N. J.
Firth-Sterling Steel Co., McKeesport, Pa.

WIRE—Steel—Also Coppered Steel—Also Galvanized Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.

WIRE AND STRIP—Zinc
Platt Bros. & Co., The, Waterbury, Conn.

WIRE TESTERS—
Scott, Henry L., Co., Providence, R. I.

WIRE, WEAVING—Non-Ferrous
Hudson Wire Co., Ossining, N. Y.

WRAPPING PAPER—Creped
Crepe-Kraft Co., Newark, N. J.

YARN TESTERS—
Scott, Henry L., Co., Providence, R. I.

WINCO

for magnet wire products that must do the job!

ENAMELED COPPER
ENAMELED IRON
ENAMELED ALLOY
ENAMELED ALUMINUM
TWISTED MULTIPLES
PARALLEL MULTIPLES

SILK COVERED
COTTON COVERED
CELANESE COVERED
GLASS FIBRE COVERED
LITZENDRAHT AND
SPECIALS TO ORDER

● There's more to present day engineering and design problems than shortages of materials, priorities, etc. There is also the question of whether specifications have been rigidly adhered to. Wire, for example, must meet such requirements as specific electrical properties, flexibility, tensile strength, laying speed, uniformity, etc.

Whether it's a buyer's or a seller's market, WINCO magnet wire products are drawn to exact specifications. Uniformity of product is guaranteed by mercury process tests and careful supervision guards against variations in consistency, structure or electrical values.

If you have a wire problem, our complete facilities are at your disposal. Send blueprints or specifications for recommendations, without obligation. Samples sent on request; write today.

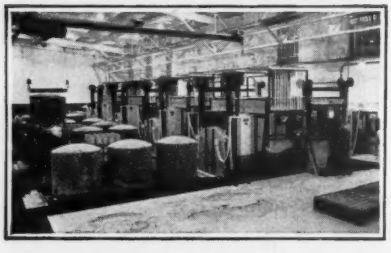
WINSTED DIVISION

WINSTED CONNECTICUT

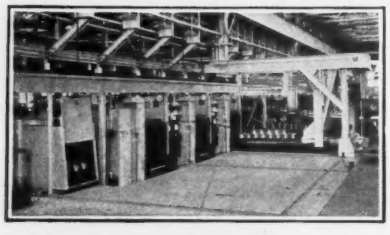
EF FURNACES

For Every Industrial Heat Treating Process

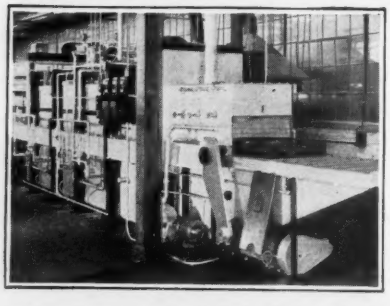
EF gas fired hearth type furnace annealing brass for cartridge cases.



EF double ended electric furnaces nitriding aircraft engine parts.



EF forced circulation furnaces, quench, cooling chamber, and material handling crane.



EF gas fired continuous roller hearth furnace annealing shell cases.

EF FURNACES ARE BUILT FOR EVERY PROCESS, INCLUDING

Annealing	Carburizing	Hardening
Copper Brazing	Drawing	Nitriding
Billet Heating	Enameling	Process Heating
Bright Annealing	Forging	Normalizing
Scale-free Hardening	Malleablizing	Ceramic Firing, etc.

EF FURNACES ARE BUILT IN VARIOUS TYPES, INCLUDING

Bell Type	Chain Belt Conveyor Type
Box Type	Chain Strand Conveyor Type
Car Type	Continuous—miscellaneous types
Hearth Type	Reciprocating Hearth
Pit Type	Rotary Hearth
Pusher Type	Rotary Drum
Recuperative	Suspended Conveyor
Roller Hearth	Vertical Cylinder
Forging Furnaces	Walking Beam

SOME ACCESSORIES WE BUILD FOR FURNACES

Conveyor Equipment	Special Atmosphere Generators
Transfer Mechanism	Pumping Equipment
Automatic Pushers	Continuous Quench Tanks
Charging Machines	Quenching Machines
Gantry Cranes	Washing Machines
Transformers	Switchboards
Pressure Systems	Contactors, etc.

THE COMPANY AND ITS SERVICE

The Electric Furnace Company, with a background of over twenty-five years of furnace building experience, is prepared to furnish any type of kiln or furnace required for any firing or heat treating process.

With both electric and fuel divisions, EF engineers are in a position to make a thorough and impartial analysis of any furnace or heat treating problem and recommend and build the best size and type furnace for the job.

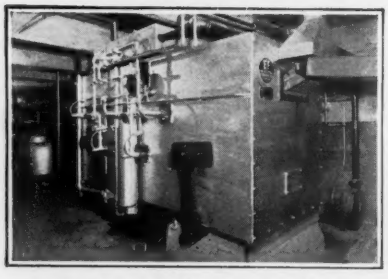
The Electric Furnace Company engineers have been able to improve heat treating processes, increase furnace production capacities or reduce the cost of heat treating operations in hundreds of prominent plants.

Consult EF Engineers on your next furnace or kiln problem. We shall be glad to give complete information, including installation and operating costs—and submit samples of products treated in equipment we have built.

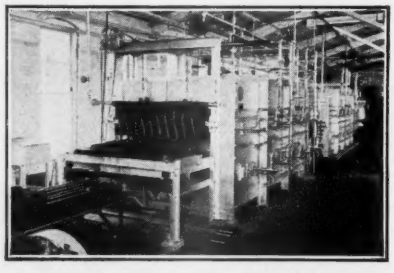
We Specialize in Building Production Furnaces.

The Electric Furnace Co., Salem, Ohio

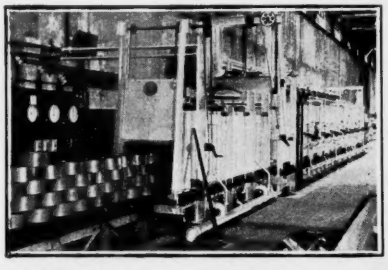
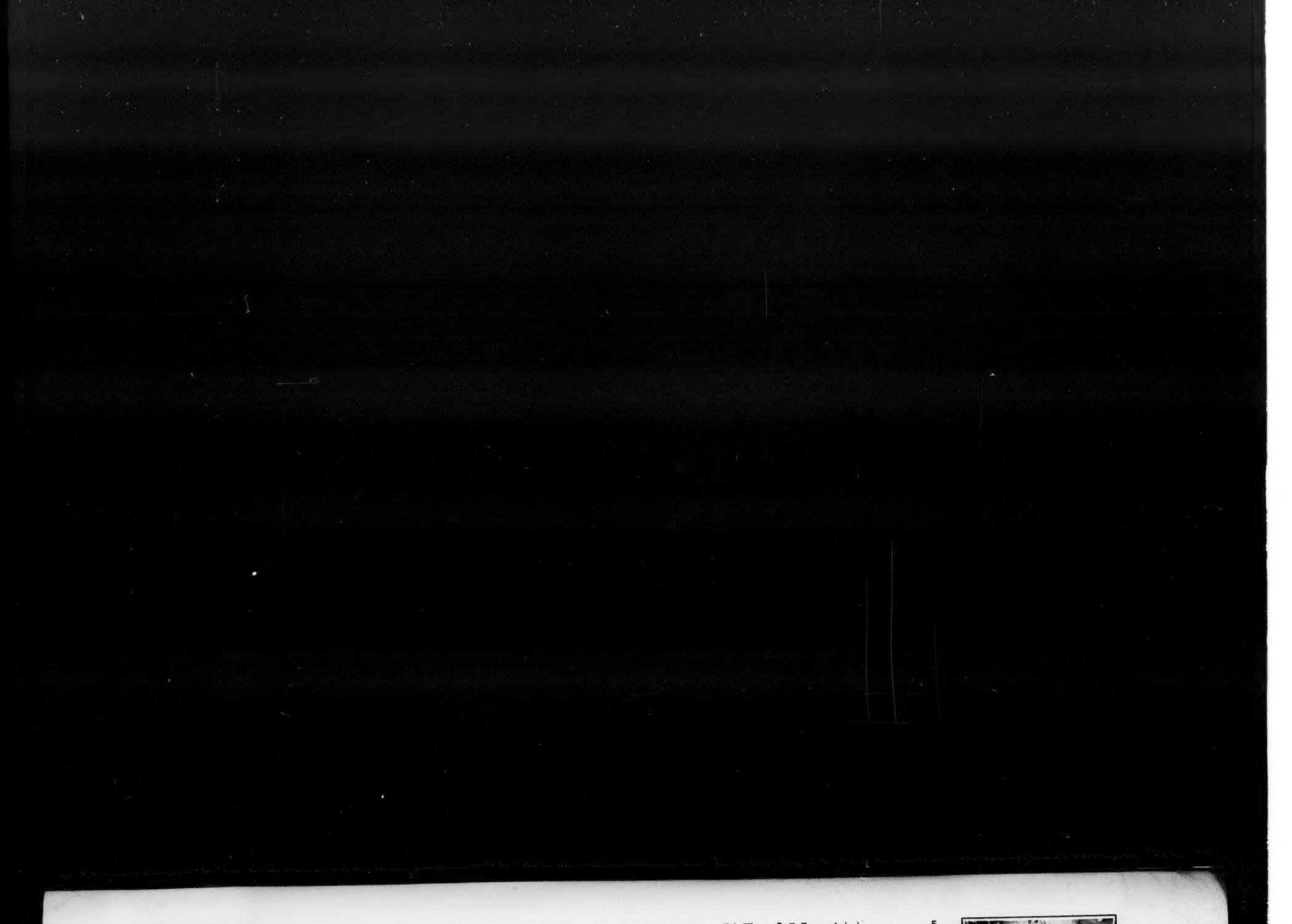
Gas Fired, Oil Fired and Electric Furnaces—For Any Process, Product or Production



EF special atmosphere furnace scale free heat treating machine gun cartridge clips—continuously.



EF gas fired special atmosphere installation heat treating shell forgings—automatically and scale free.



EF gas fired continuous roller hearth type furnace annealing 10,000 lbs. cartridge brass per hour.